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NATURAL HISTORY

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A symposium of articles dealing with her wide range of achievement

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SNOW WORMS—WHEN SNAKES SHARE FOOD, WHAT IS THE SEQUEL?

JOURNAL OF THE AMERICAN MUSEUM OF NATURAL HISTORY

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NATURAL HISTORY

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AN OLD SILVER-BACKED MALE

This gorilla, the first to be collected by Mr. Akeley, is mounted for the group that will find place in the Roosevelt African Hall. He is advancing on all fours—the normal walking position—with his feet flat on the ground and his hands doubled under so that only the knuckles touch the trail. The posture and mild facial expression of this gorilla, the first specimen ever mounted by a man who had actually seen a live gorilla in the wild are in marked contrast to the erect body and the ferocious aspect of the traditional gorilla of story, of taxidermy, and of sculpture.

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NATURAL HISTORY
VOLUME XXIII SEPTEMBER–OCTOBER NUMBER 5

Gorillas—Real and Mythical

BY CARL E. AKELEY

IT is ordained that the projected Roosevelt African hall of the American Museum shall follow the ideals and customs of modern museum exhibition. Into it shall go nothing but the truth. Forty groups of African mammals and probably two or three times forty species will be represented in their natural environment, doing normal and natural things. And when we say that in this great hall only truths are to be represented, we are committing ourselves to an enormous task; for we mean by such a statement that every detail in relation to an animal, its habits, and environment must be carefully studied at first hand by the men who are to prepare and assemble these groups. A vast amount of toil is involved in physical preparation, but, before that work is undertaken, labor equally great and even more important will be necessary to correct inaccurate theories that have persisted about little-known African animals.

Although, due to the fact that the gorilla is recognized by many as man's closest relative, the study of this ape is perhaps more interesting and more important than the study of any other animal, there is no other African beast that has been the center of so many fables and superstitions. What Huxley wrote about the world's knowledge of the real gorilla is almost as applicable to the situation today as to that of 1863. In regard to the difficulty of obtaining sound knowledge respecting the habits and mode of life of the man-like apes, he says:

> . . . to the ordinary explorer or collector, the dense forests of equatorial Asia and Africa, which constitute the favourite habitation of the Orang, the Chimpanzee, and the Gorilla, present difficulties of no ordinary magnitude; and the man who risks his life by even a short visit to the malarious shores of those regions may well be excused if he shrinks from facing the dangers of the interior; if he contents himself with stimulating the industry of the better seasoned natives, and collecting and collating the more or less mythical reports and traditions with which they are too ready to supply him.
>
> In such a manner most of the earlier accounts of the habits of the man-like Apes originated; and even now a good deal of what passes current must be admitted to have no very safe foundation. The best information we possess is that, based almost wholly on direct European testimony, respecting the Gibbons; the next best evidence relates to the Orangs; while our knowledge of the habits of the Chimpanzee and the Gorilla stands much in need of support and enlargement by additional testimony from instructed European eye-witnesses.

Nor are the inaccessibility of the gorilla forests and the persistence of the myths of an imaginative and superstitious people the only obstacles to the progress of the scientist who would separate the truth from the fiction in our natural history literature. When once an interesting tale has been well told, it is likely to become established through constant reiteration by men who are merely writers rather than observers. The naturalist going into the field to study an animal for the first time usually has read such writings and is under the spell of the erroneous impression that they convey. When he observes an animal in the

distance and is unable to distinguish clearly what it is doing, he naturally interprets its actions in the light of the tale he has read. I have known naturalists who were convinced in this way that they had observed something

A notable representation of the mythical gorilla, the bronze by Fremiet. It was suggested by the legend of the abduction of native women by vicious old male gorillas

which they had not seen at all, and who then confirmed such natural history fiction as eyewitnesses. Early tales of the gorilla, most of them based on hearsay, have so much in common, and the reports of more recent explorers duplicate these early accounts in so many respects, that one is inclined to feel that writing gorilla stories has been a game of follow the leader.

Had the American Museum undertaken to prepare a gorilla group five years ago, using skins which could be purchased in the open market, and planning the group as carefully as possible in accordance with the accumulated data of the past seventy-five years, I have an idea that that group would have had a much greater appeal to a public thirsting for excitement and sensation, than the group which will result from the knowledge recently acquired. Such an imaginary group would of necessity have shown the gorilla as a ferocious creature in a setting of gloomy forest or mysterious jungle. There would have been one specimen in a tree, another walking erect with a staff or club in one hand, and perhaps a third beating its breast with its fists and opening its cavernous mouth as though roaring with rage. A house or nest, ingeniously constructed somewhere between earth and sky, would have been required to make the picture complete. Taking the records literally, there would have been justification for depicting an old male in the act of crushing with his teeth the barrel of a hunter's gun.

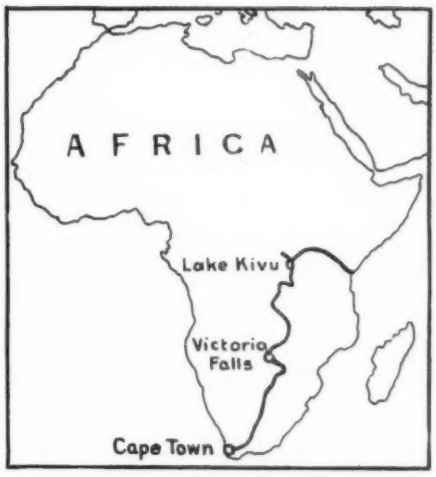
It is not necessary to rely on the imagination altogether in visualizing the gorilla as he has long been conceived. The American Museum of Natural History has been the temporary custodian of one of the old representations so horrible and so realistic that it would terrorize the very animal it is supposed to portray. (Be it said to the credit of the Museum that, when this statue came into its possession, it was put away in the basement.) I refer to the bronze by E. Fremiet, the most striking sculpture of a gorilla that we have. It shows a beautifully modeled animal in the act of bearing away on his right arm a lovely native woman, who, by the way, has more of the earmarks of a Parisian model than of an African savage. The gorilla, of course, is walking erect, on his legs; one hand clasps his captive, the other hand contains a great rock, which presumably he is about to throw at his pursuers. Al-

though they have already succeeded in lodging a huge arrow in his heart, he apparently has an abundance of strength and energy to defy them and to make away with his prize.

While the number of mounted gorillas in the museums of the world is not very great, still many of these museum specimens are almost as misleading as Fremiet's bronze.

The gorilla group in Roosevelt African hall will be a great disappointment to that portion of the public which has expected and would prefer to see the gorilla made as human and as horrible as the imagination has painted him, for it will show the gorilla as a great amiable creature in a setting of extraordinary beauty. In the group nothing but facts and truth will be told—not all the facts nor all the truth, for additional researches will undoubtedly widen our knowledge of this animal—but the story of the gorilla as I found him in November, 1921, near Lake Kivu in the eastern Congo, on the glorious, forested slopes of the extinct volcanoes, Mikeno and Karisimbi. Three weeks with the gorilla is indeed a short time in which to learn his story. I do not pretend that my record is complete; but I was extremely fortunate in my opportunities for observation and in securing specimens and data. And to the tale that is told by my group there will ultimately be added, I hope, the other ninety-five per cent of the gorilla's story.

During the time I spent in the gorilla forest, I was constantly searching for a setting to be reproduced for the gorilla group. In the preparation of a habitat group, it is always a difficult undertaking to find a setting that is characteristic and that in addition has those qualities that contribute to an interesting and attractive composition, one



Map showing the location of the gorilla country and the route taken by Mr. Akeley on his recent expedition. Entering Africa at Cape Town, he traveled northward by rail, by boat, and on foot into the mountainous region just north of Lake Kivu, where he found gorillas

that gives a comprehensive idea of the country and at the same time requires the minimum of expense in reproduction. Until the day that the last old gorilla was shot I had only the vaguest notion of what setting I should choose. It seemed to me that I could find nothing that was adequate. But when the old male of Karisimbi rolled down a steep incline, and came to rest against the base of a great dead tree clothed in mosses and in the rank growth of tropical vegetation, through the branches of which one looked out across a beautiful forested valley to the gorgeous pinnacle of Mikeno on the right and to the smouldering craters of Nyamlagira and Chaninagongo in the distance, I realized that the old gorilla had found the setting that I sought. At no time has there been thought of looking farther. It is a place much frequented by the gorillas, where some of their favorite foods grow in abundance and where, their hunger satisfied,

The peaks of the gorilla country at sunrise—Visoke summit just visible over the left shoulder of Mikeno (center), and Kirisimbi at the right. The location of the proposed gorilla sanctuary is marked by this triangle of mountains

they bask lazily in the sunshine of their little empire.

The old male of Karisimbi will be shown beating his chest. This attitude should satisfy those who are loath to give up the sensational tales of gorillas until they learn that it does not indicate rage or ferocity. It is merely an expression of curiosity. The animal has seen a movement in the bushes in the valley below him and he rises up and beats his chest and perhaps barks—for the so-called roar of the gorilla of the Kivu region, at least, is best described as a long-drawn-out, throaty bark. The other male, the first gorilla that I ever saw alive, will be shown on all fours in the normal walking attitude. One hand will be poised, as he hesitates in his advance and looks at the observer with the expression that he wore in life—an expression of passive interest. One old female will be lying lazily on her back against the base of the tree. When I came in sight of a troop that was unconscious of my presence, some of them were sure to be loafing about in some such attitude as this. A second old female, feeding on the vegetation, and a youngster of about four years will complete the group.

Before I discuss further the experiences which justify my belief that the gorilla is a good-tempered beast, who expresses himself by a bark rather than a terrifying roar, who touches the ground with his hands in walking, and is non-arboreal in his habits, it may

The summit of Chaninagongo draped in smoke and clouds, viewed from the spot on the slopes of Karisimbi where the last old male was killed. This silhouette of the extinct volcano is to be a detail of the painted background for the gorilla group in Roosevelt African Hall

be well to devote a little space to the sources of the prevalent conception which it is my purpose to controvert.

About the close of the sixteenth century, the story of Andrew Battell, an English captive of the Portuguese of Angola, established the idea that the ferocious beast walked erect, slept in trees, and was the terror of the natives. After a description which practically identifies his "pongo" as the gorilla, Battell says:

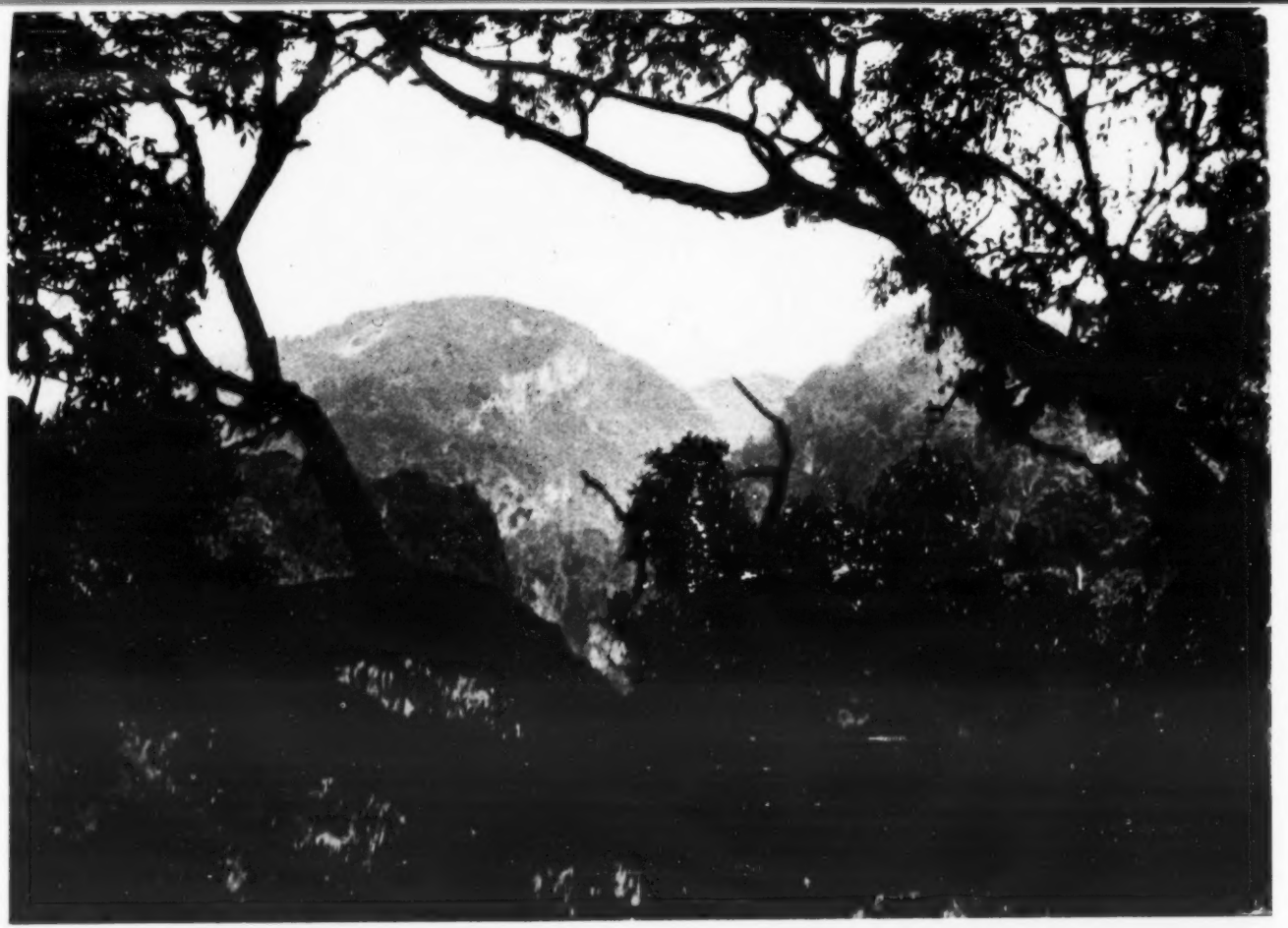
> He differeth not from a man but in his legs: for they have no calfe. Hee goeth alwaies upon his legs, and carrieth his hands clasped in the nape of his necke when he goeth upon the ground. They sleep in the trees, and build shelters for the raine. They feed upon fruit that they find in the woods, and upon nuts, for they eate no kind of flesh. They cannot speake, and have no understanding more than a beast. The people of the countrie, when they travaile in the woods make fires where they sleepe in the night and in the morning when they are gone, the Pongoes will come and sit about the fire till it goeth out; for they have no understanding to lay the wood together. They goe many together and kill many negroes that travaile in the woods. Many times they fall upon the elephants that come to feed where they be, and so beate them with their clubbed fists, and pieces of wood, that they will run roaring away from them. Those Pongoes are never taken alive because they are so strong, that ten men cannot hold one of them; but yet they take many of their young ones with poison arrowes.

Battell's uncomplimentary opinion of the gorilla was widely disseminated through the exaggerated translation of

THE KIVU FAIRYLAND

One of the wooded valleys of Mt. Mikeno in the home of the gorillas—an enchanted forest of graceful tree trunks, lacy foliage, ferns, beard mosses, and tangled vines. The most beautiful scenery in all Africa, Mr. Akeley believes, is in this mountainous region just north of Lake Kivu in the Belgian Congo

tainous region just north of Lake Kivu in the Belgian Congo



A SCENE ON MT. MIKENO

View of a peak of Mikeno from a trail along a ridge that overhangs one of the mountain's deep-cut valleys. It was on a steep trail at the base of the white cliff on the right slope of the peak that Mr. Akeley killed his second gorilla

it that appeared in 1748 in Buffon's *Histoire generale des Voyages*. In view of the fact that habits of the chimpanzee have frequently been attributed to the gorilla, it may be well to note that this book regards pongoes, jockos (chimpanzees), and orangs as a single species.

The account of an African missionary, Dr. Thomas S. Savage, based on skulls and information given him by the natives of the Gaboon region, appeared in the Boston *Journal of Natural History* in December, 1847. After giving a substantially accurate description of the gorilla's mode of progress on all fours, he adds that it is "said to be much inclined" to the walking posture. He speaks of their "dwellings" made of a few sticks and leafy branches supported by the crotches and limbs of trees, and of their exceeding ferocity and their habit of always taking the offensive. The native testimony which he records in the following paragraph has probably inspired in part at least the mounting of more than one ugly museum specimen.

> It is said that when the male is first seen he gives a terrific yell that resounds far and wide through the forest, something like kh-ah! kh-ah! prolonged and shrill. His enormous jaws are widely opened at each expiration, his under lip hangs over the chin, and the hairy ridge and scalp is contracted upon the brow, presenting an aspect of indescribable ferocity. The females and young at the first cry quickly disappear; he then approaches the enemy in great fury, pouring out his horrid cries in quick succession. The hunter awaits his approach with his gun extended; if his aim is not sure he permits the animal to grasp the barrel and as he carries it to his mouth (which is his habit) he fires; should the gun fail to go off, the barrel (that of an ordinary musket, which is thin) is crushed between his teeth, and the encounter soon proves fatal to the hunter.

It was Doctor Savage who first gave the *Engé-ena* the name "gorilla," wisely avoiding the misused term pongo.

There is a striking similarity between the account of Doctor Savage and that given five years later before the Academy of Natural Sciences of Philadelphia by Mr. Ford, another visitor to the Gaboon. Even the episode of the animal's crushing the musket between his teeth is repeated by Mr. Ford, although he discredits the stories of elephant-driving and house-building as tales told to children by the natives. He does not pretend to have seen a gorilla's attack, but he describes the animal in vivid terms as he makes his onset, "with his crest erect and projected forward, his nostrils dilated, and his under-lip thrown down, at the same time uttering his characteristic yell, designed, it would seem, to terrify his antagonist."

The intrepid little French-American, Paul Du Chaillu, was the first white hunter to kill a gorilla. The account of his adventures appeared in print at that stage in the history of tales of travel when publishers, like the motion picture producers of today, feared to rely upon the unadorned truth to hold the public's interest. We have it on good authority, that the narrative was twice rewritten before his editors considered that it had sufficient popular appeal. His stories are the type that small boys carry away to the attic to devour on rainy afternoons. They are still occasionally read and they have done much to perpetuate the first erroneous reports of the gorilla. Familiar with the gorillas's reputation for evil, Du Chaillu naturally enough ran the whole gamut of emotions as he approached his first encounter. That passage from his book which at first reading is most damaging evidence against the great ape, appears as a

harmless recital when all the words and phrases that apply to the hunter's state of mind are dropped out. In spite of their fame as offensive warriors, the first gorillas surprised by Du Chaillu fled into the deep forest. The hunters pursued until they were exhausted but, "the alert beasts made good their escape." And the "charge" of his old male was proceeding hesitatingly, step by step, when Du Chaillu's gun interrupted it.

Although most of the reports of gorillas have been from the west coast, there had come to me considerable corroboration of the rumors that there were also gorillas in the Lake Kivu country of Central Africa. Before I left Africa in 1911, a report reached me that a man named Grauer had come out of the Kivu region with eight gorilla skins. Before my departure for the Kivu country in 1921, I received a letter from Mr. C. D. Foster, who had killed a male and a female and taken a baby on Mt. Mikeno. Prince Vilhelm of Sweden had hunted here, also, and Mr. T. Alexander Barnes was in the Kivu country hunting gorillas for the British Museum when we entered it.

At the time of my departure I had heard little of what these present-day hunters had to say of the Kivu gorilla, but I had never accepted the accounts of the Gaboon gorilla's ferocity. Having seen the "follow the leader" game played in the case of other animal stories by fellow naturalists in my own time, it was not difficult for me to disregard early accounts and enter upon my study of the gorilla with an open mind. If I was prejudiced at all when I entered the Kivu country in the fall of 1921, that prejudice was decidedly in favor of the gorilla. Basing my theory upon my observations of the habits of the other apes and upon my general belief in the good temper of unmolested wild animals, I was prepared to find in him a decent and amiable creature. I was not disappointed.

I saw no indication that the gorilla is in the least aggressive or that he would fight even on just provocation. I have trailed him through his jungles, come on him at very close quarters, and shot him without seeing the slightest intimation on his part of an intention to start a fight. The first gorilla that I ever saw alive was a lone old male, who might have been expected to show some war-like spirit if that had been a characteristic of his tribe. I saw his face—ugly and wrinkled, but mild and gentle—across the valley and caught a glimpse of his gray back as he went over a log and up the slope through dense vegetation. When I finally overtook him, I was first aware of his presence by his guttural bark. He was crouching motionless thirty feet away in the death-like silence of the sun-lit morning. There was no "devil's tattoo" of chest beating; no threat of a charge—although, had he been inclined to charge, he had merely to drop down on us. He barked four times. My shot cut his fourth bark short. So ended my first gorilla hunt. It had been a thrilling experience, but thrilling because of tradition rather than because of fact.

Those who have maligned the gorilla's good name have cited his "strange, discordant, half-human, devilish cry" and his beating of his chest "with his huge fists till it resounded like an immense bass drum," as his modes of offering defiance. In my opinion both of these habits have been misinterpreted. The only way I can describe the utterance of a gorilla is as a hoarse, gutteral, prolonged bark. It

Enlargements from Mr. Akeley's motion pictures, the first pictures of any kind ever taken of live, wild gorillas. Although the animals were aware of Mr. Akeley's presence, they paid little attention to him, the old female even settling herself comfortably in the crotch of the tree as if to go to sleep. The bottom picture shows two of the gorillas with clasped hands, as the old one helps the youngster to descend. The gently sloping trunk on which the gorillas were perched when Mr. Akeley photographed them, was no more than ten feet from the ground

has no resemblance whatever to a roar and there is no resonance in the sound. I doubt if on a perfectly still day it could be heard for more than half a mile. In some cases it is a warning signal to the rest of the band; in others, it is an inquiring challenge addressed to the invader of his domain and has some such implication as the words, "Who are you? What are you doing here?"

I was keen to see a gorilla beat his chest and was fortunate not only in witnessing this action, but also in making a motion picture record of it. In this motion picture the female is shown in the crotch of a leaning tree, to which she had ascended with her two youngsters to get a better view of me. At a time when they were all but indifferent to my presence (although I was in plain sight), she suddenly rose up and beat her chest; then immediately dropped down again. A moment later she was making herself comfortable with the apparent intention of going to sleep if her youngsters would let her. One of the youngsters rose up on his legs two or three times, each time striking his chest once and, as he went down again, hitting the log once or twice with his hands. They made no vocal sounds and I could not hear the beating of the chest from where I stood operating the motion-picture camera, at a distance of perhaps two hundred feet. There was no wind to carry sound either to or from me. The beating of the chest is a nervous expression of curiosity, the equivalent of which we find in the actions of many of the smaller apes and monkeys, such as their habit of beating the ground or their perch with their hands or feet, while they are perhaps making vocal sounds.

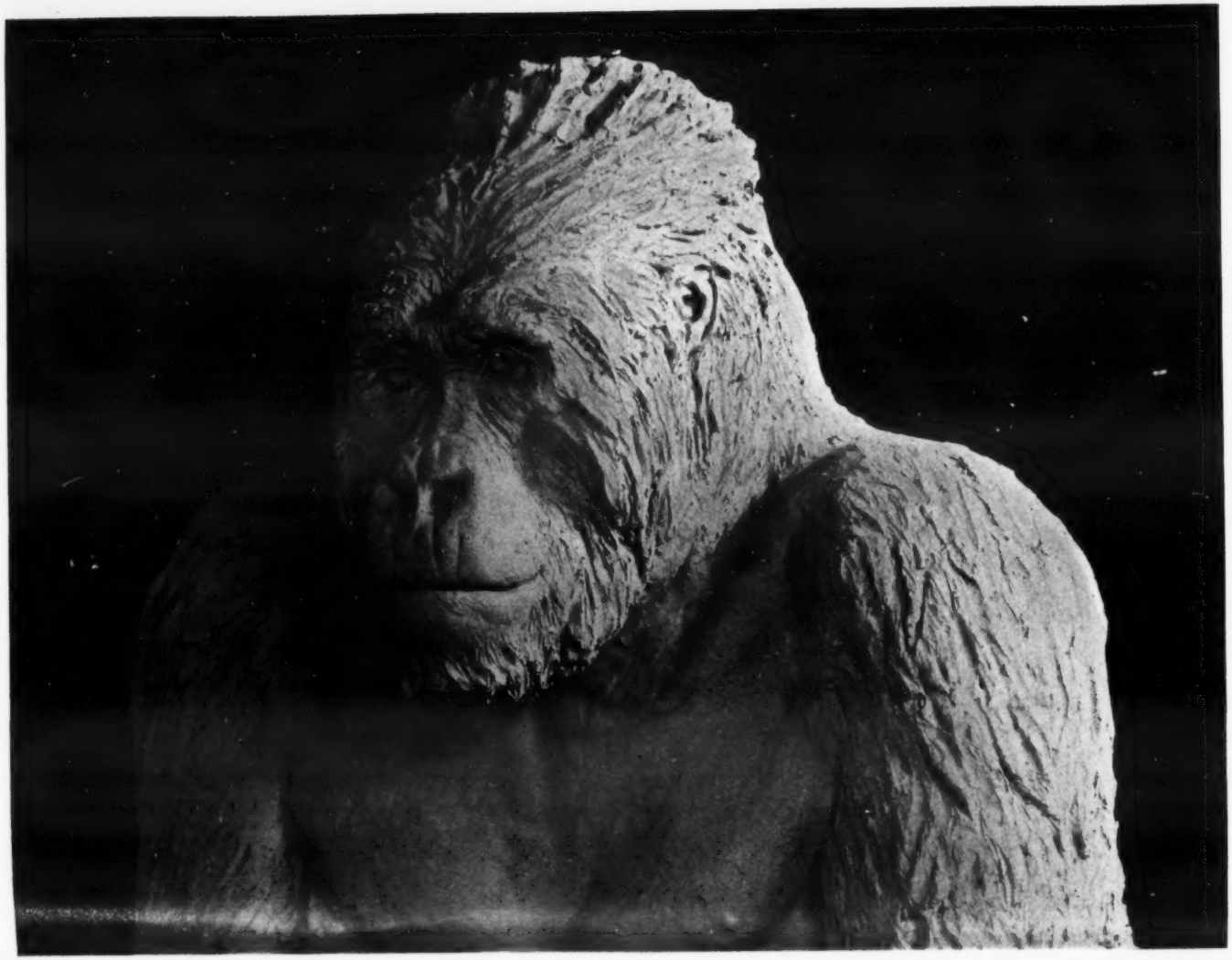
The natives of this region have no fear of the gorilla. They wander

through the gorilla country to collect firewood and, during the dry season, pasture their cattle on the open places in the gorilla forest. We found fresh gorilla tracks on the fresh trail of a herd of cattle. Some of my guides and my gun bearer were trappers and hunters in the gorilla forests and were thoroughly familiar with them. At no time did the guides or gun boys show any indication of anything more than casual interest even when we approached very close to gorillas. In direct contrast to the behavior of natives on the elephant trail where they are terrified when unprotected by the rifle of the *bwana*, the gun boy who went with me on the gorilla hunt would hand me the gun as we were getting near a band and would go in front of me unarmed, cutting the nettles out of the way or clearing a path. Then, when he thought I might want to shoot, he would lie down on the ground in front of me. With dangerous game you can depend on your boys' dropping behind you, where they are ready to lead the retreat, if retreat becomes necessary. At no time did I see a gorilla move with a rapidity that would suggest the possibility of his overtaking a man in a fair race. The lumbering creatures with their comparatively short legs are not built for speed.

While I am certain that normally the gorilla is a perfectly amiable, good-natured creature who would not look for trouble, yet I am willing to concede that in regions where he is more or less in competition with the natives for food, and where he is constantly harrassed in his efforts to fight hunger, an old male might occasionally become what may be called a "bad gorilla." No doubt from his standpoint a raid on the native gardens is justified, for so far as he knows the food in these gardens is just as much his as the natives'. Now and then under such conditions a gorilla becomes conscious of his superior strength and may naturally enough grow bold and aggressive. And it is hard to imagine a more formidable opponent than an enraged gorilla. The strength of his arms, as one may judge from the measurements, is tremendous. This strength, backed by the great weight of his short coupled body, would make it useless for an antagonist to struggle against him in a hand-to-hand encounter.

Very few gorillas have been weighed. Mr. T. Alexander Barnes, a thoroughly dependable and thoroughly honest ob-

M'Gulu, a guide of the gorilla country, with one of the knives used by the natives in clearing away the nettles or cutting a path through the dense undergrowth of the gorilla forests. Progress is slow where such paths must be made



"THE OLD MAN OF MIKENO"

A portrait bust of his first gorilla, modeled by Mr. Akeley for casting in bronze. Through his sculptures, as well as through the written and the spoken word, Mr. Akeley has been telling the stories of African wild animal life as he knows it. A number of the incidents of his acquaintance with elephants and lions have already been recorded in bronze.

This bust of a gorilla, the benign expression and deep-set eyes of which are a contradiction of the age-old tradition of the ferocity of the big ape, is the first sculpture completed by the artist in a contemplated series representing gorillas. The bronze is his interpretation of the gorilla's "character," a study intended to convey to others his impression of the creature that he came to know two years ago in Africa.

server in describing a large male from the Kivu which has been mounted by Rowland Ward and Company, states that its weight was approximately 450 pounds. The weight is frankly estimated. As a matter of fact, the measurements of Mr. Barnes' gorilla are somewhat smaller than those of the old male of Karisimbi, which actually weighed 360 pounds. In another case, 700 pounds was alleged to be the weight of a gorilla, the skeleton of which was a little smaller than our Karisimbi male. At least we have a standard now to go by—the measurements of the skeleton of the Karisimbi male and its actual weight. They are given below:

Height	5 feet, 7½ inches
Weight	360 pounds
Chest	62 inches
Upper arm	18 inches
Reach	97 inches
Calf	15¾ inches

We are in the habit of speaking of the gorilla's long arms, but it is more accurate to say that his spinal column and his legs are short. Certainly, because of the greater correlation in the development of arms and chest, the length of the arm should be considered in relation to the thorax rather than to the spinal column. From the arm and chest measurements of man and of the gorilla, it appears that the gorilla's arm is relatively shorter than man's.

Fables of the capture of women by old males who carry them off to their fastnesses in the forest have long been circulated as evidence of the gorilla's strength and ferocity. These tales are as legendary as the fable of the ostrich that hides its head in the sand and believes that it has concealed its entire body, or of the elephant that fears the mouse because it might run up his nose. There is about as much inducement for a mouse to run up an elephant's trunk as to make his way up a fire hose when the stream is turned on with full force. "The silly stories about their [the gorillas] carrying off women from the native towns," wrote Doctor Savage, ". . . have origin in the marvelous accounts, given by the natives to credulous traders." Eduard Reichenow thinks this fiction may have had its origin in an attack on a plantation, where food is competed for and where women do the agricultural work.

Contrary to popular theory, the gorilla is not a tree-living animal. Those already described as beating their chests before the motion-picture camera, were the only ones that any member of our party saw off the ground. On that occasion, one of the two youngsters climbed a nearly upright tree to a height of about ten feet. (As I write, there are three small boys at an equally great height in an upright locust tree just outside my window.) A few seconds later this first gorilla youngster joined the old female and the other baby in a second tree, the trunk of which slanted so that a dog could easily have run up it. Most of the tree trunks were so covered by moss and other vegetation that they would surely carry the marks if gorillas were in the habit of climbing them, but I saw no indication anywhere of trees having been climbed by gorillas. It is difficult to convince oneself that these heavy, rather sluggish creatures are any more arboreal than man, and I do not believe that they are. Mr. T. Alexander Barnes bears me out in this belief. In the *Wonderland of the Eastern Congo*, he writes, ". . . they never sleep in trees but prefer to make a nest or shelter on the ground. . . Judging from my observation it may be said that they scarcely ever climb trees and moreover are not partial to fruits and nuts, preferring to

feed on grass herbage and bamboo leaves." Reichenow admits that the gorilla to a greater extent than the chimpanzee is a stranger to tree-living; that he nests always on the level of the ground; that, if he climbs for food or at the approach of danger, he must come down the trunk he ascends, inasmuch as he cannot swing from one tree to another.

I cannot corroborate the evidence of these two hunters that nests are occasionally built by bending over young bamboos or other branches and weaving them together to form a springy platform. In no case did I see such a bed. There were many nests, sometimes as many as eight or ten in a group, some of them protected by the overhanging vegetation of a great tree trunk, while others were scattered about in the open. However, they consisted merely of a hollowed-out spot where the gorilla had lain. The beds were constructed in the simplest possible manner wherever the gorilla decided to spend the night by drawing together whatever of leaves or débris happened to be within his arm's reach. Apparently none of the nests had been used more than once, as they almost invariably contained droppings that had not been trampled on or lain on. Perhaps the fact that the gorillas always sleep in fresh, clean beds is one of the reasons that they are so splendidly healthy and absolutely free from parasites, external or internal.

There has been a fairly general agreement among naturalists as to the fact that the gorilla progresses on all fours, but the three-and-a-half-century

A gorilla bed on the floor of the forest, made by drawing together the grasses, leaves, and débris that lay easily within arm's reach. Mr. Akeley observed many of these rude beds, frequently at the bases of trees from the mossy trunks of which trailed hanging vegetation sometimes screened the sleeping place

old fiction that he is much inclined to the erect posture is still popularly accepted. In spite of the fact that he seems to be evolving toward a two-legged animal, his body leans forward at an angle of less than 45 degrees and his hands touch the ground as he walks. His feet are placed squarely on the heel, bearing most of his great weight, but his fingers are doubled back so that only the knuckles touch the trail. As a matter of fact, the gorilla cannot straighten the fingers unless the wrist is bent. When the wrist is straight, as in the act of walking, the fingers automatically close like the claw of a bird when it settles on a perch. The preserved carcass of a young gorilla was brought back to the studio for reference and study. As a result of treatment, the whole muscular system of this preserved specimen is now more relaxed than it was when freshly killed, but even in its present condition, the weight of the body as it hangs with the fingers hooked over a support is not sufficient to loosen their grasp. This peculiar characteristic, a legacy of his arboreal life, is probably a great aid to him as he grasps roots and branches in the tortuous ascent of a steep hillside.

I saw all told from twenty-five to thirty gorillas and got no hint that they ever progress except on all fours. Even when in going away from me they stopped to look back, they remained on all fours. The only occasion on which we saw gorillas in any other attitude was that recorded in my motion pictures, when the female and the youngster rose for an instant and beat their chests. It is difficult to imagine one of these bulky animals making progress in an upright position on his comparatively weak legs, and, if he ever does so, it must be with no more ease or grace than a heavily built trained dog would exhibit in making a similar attempt. One could scarcely expect to find an animal adapted for walking erect in that mountainous region; indeed, in that country of precipitous ascents

Plaster casts of gorilla hands and foot, made in the field when the specimens were taken. To the left are the hand and foot of a female. Note especially the development of the heel and the position of the big toe. The clenched fist to the right is that of the larger male

The lone male of Karisimbi, the gorilla shot by Mr. H. E. Bradley, one of Mr. Akeley's companions. In spite of the animal's great strength and his 360 pounds, he offered no defiance when attacked

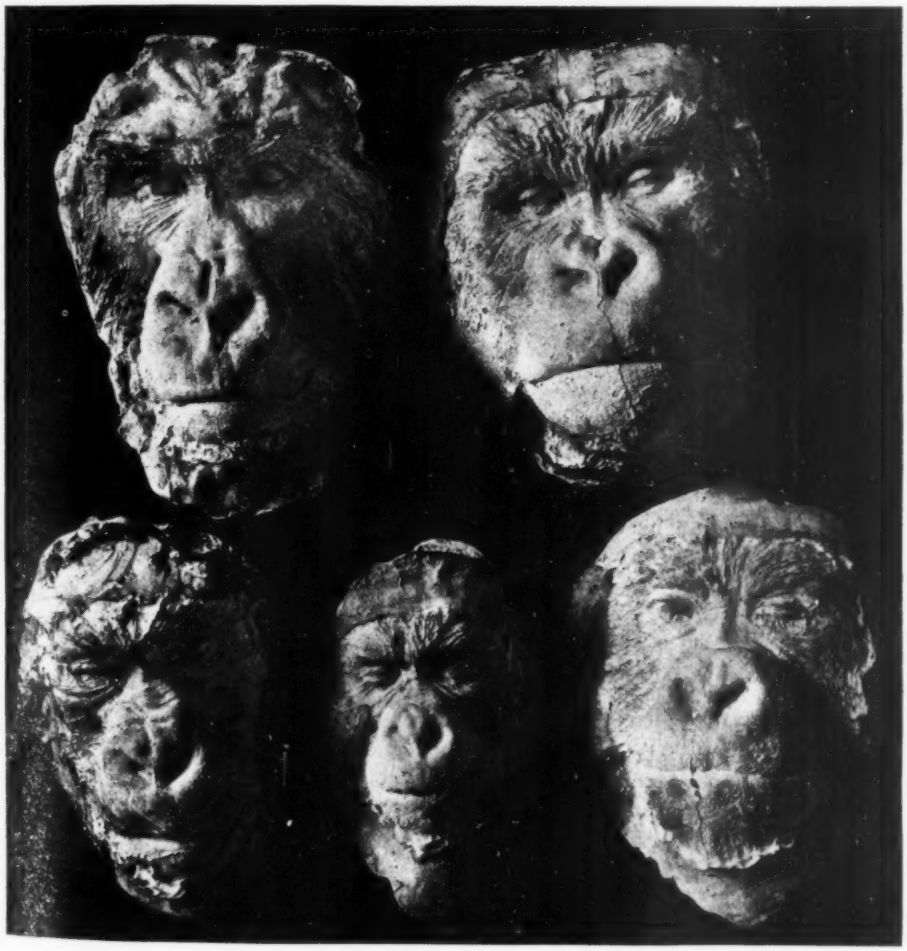
through dense underbrush, man himself is frequently forced to drop on all fours in order to make any progress on the gorilla trail.

It is not strange that the average individual pictures the gorilla walking jauntily on two feet. The earliest wood-cuts showed him standing erect and cyclopedias and natural histories have continued to represent him in that way. One of the worst and most recent offenses is to be found in J. A. Thomson's *Outline of Science*, where a colored plate shows a gorilla with a horribly ferocious face walking freely erect. Hæckel in his *Anthropogenie* published a plate of a gorilla skeleton side by side with that of a man and in the same posture. Museums have mounted skeletons in similar fashion up to the present day. This practice is justified inasmuch as the unnatural pose is for purposes of comparison, but unfortunately the visual image of such skeletons remains in the popular mind long after the explanation accompanying them is forgotten.

The death masks of my five gorillas are a priceless record. The first old male, one female, and the youngster were killed on a ridge of Mt. Mikeno and they bear unmistakable resemblances to one another. The other male and female, killed on the slopes of Kari-

simbi, likewise resemble each other, but their physiognomies are totally different from those of the Mikeno specimens. The feeding grounds of these two ridges were separated by a valley, which the gorillas were constantly crossing back and forth. The suggestion therefore is obvious even from this slight amount of material that the gorillas live in family groups with a tendency to interbreed.

Both of the males in the group were lone males at the time we came up with them. There was a considerable band—how many I do not know—on the occasion of the photographing of the female and the two youngsters. All the others remained out of sight in the vegetation beneath the slanting tree and, although, after completing the picture, I followed them for a considerable distance, catching occa-



Death masks of the five gorillas. Although a great part of their interest lies in the individuality of each countenance, there is marked "family" resemblance in the faces of the Mikeno gorillas (upper left and two lower left), and also in the faces of the Kirisimbi specimens (upper and lower right)

A tangle of tropical vegetation of low growth and splendid trees on the western slope of Mount Mikeno,—a typical view of the dense and beautiful forests of the gorilla country

Mr. Akeley's gorilla camp,—the skins in the foreground, the skeletons on the rack, and the preserved body of the young gorilla suspended from the ridge pole of the tent

sional glimpses of them, I saw no male. On the last day in the forest, I set out with the idea of securing one more specimen. Doubting whether it would be legitimate to use the two males already secured in a single group, I wanted to obtain another female in order to have a pair in excess. We found the fresh track of a single old male, which we followed up the slope through the bamboos, and when we finally came up with him, there were in addition to a number of females and youngsters at least two, and I believe three, other old gray-backed males in the troop. There were three in sight at one time and I am fairly certain that I saw a fourth disappear. I realized on the instant that it was perfectly legitimate to use two old males in my group. There was no valid excuse for killing another gorilla. And so, instead of firing my gun, I took the final shot with the motion-picture camera as the troop disappeared over the top of a ridge. Altogether I saw six or seven males at distances varying from ten to three hundred yards and no one of them stood erect and beat his breast.

After my first expedition into the gorilla country, I am more convinced than ever not only that the gorilla is one of the most fascinating and important objects of study in the realm of natural history, but also that his disposition is such as to permit the most intimate observation of his habits. A few days in the gorilla country and one instinctively falls into the way of referring to this amiable giant as "he" in the human sense. A few weeks of casual acquaintance and one is fired with a desire to ferret out the answers to a hundred questions about this little-known relative of man—questions of increasing importance to scientists and physicians in their efforts to understand and aid man himself. Probably no other project of so moderate a size is likely to lead to such immediate and valuable scientific results as that which will make of the Kivu region a sanctuary, where the gorillas under the protection of man may grow more and more accustomed to human beings and where through a series of years they may be observed and studied.

A DINNER TÊTE-À-TÊTE

Three snakes started to feed on the same toad and two of them are following the toad in its descent down the largest of the snakes. The incident occurred at the Boy Scout Camp Museum, Kanohwahke Lakes, Palisades Interstate Park

When Snakes Share Food, What is the Sequel?

By B. T. B. HYDE

Educational Director, Kanohwahke Scout Camps, Palisades Interstate Park

AN unusual exhibition of an odd trait in snakes occurred the summer of 1922 at the Boy Scout Camp Museum, Kanohwahke Lakes, in the Palisades Interstate Park. One day when toads were being fed to a number of garter snakes, it was observed that one of the smaller snakes seized a toad by its right hind leg, about the same time that a much larger snake decided to begin upon the head of the toad; and not to be left out (as it proved) another small garter snake took possession of the left hind leg. All three were thus feeding from different directions toward a common center, and presently the largest snake had the original meal and its attendant banqueters well down inside him for a distance of about ten inches. At that juncture I was able to secure the photograph that is reproduced on the opposing page. A few moments after the picture was taken, for some reason—perhaps too much action inside the devourer-in-chief—the two disappearing members of the triumvirate emerged again, the original claimant still attached to the toad and as intent as ever upon securing his well-earned repast.

Although it is unusual to find as many as two snakes passing simultaneously into another, it is an observation cited by many that when two snakes are engaged in feeding upon the same creature, one of them often swallows the rival claimant as well as the prey. Mr. F. W. Fitzsimmons, for instance, in his exhaustive study of the snakes of South Africa, reports several experiences with captive snakes in the snake park attached to the Port Elizabeth Museum and tells how at feeding time when two snakes attack the same live animal, the one whose jaws work the more rapidly, keeps on drawing in both the original food and ultimately the other snake. Snake number two seems not to realize the situation and makes no attempt to disgorge; it maintains its hold on the prey and passes into its rival, even though it be the more aggressive of the two, and through its struggles causes the larger snake to be folded back and forth. At times, however, the victimized snake, when part way down its captor, makes its presence felt so forcibly that it is ejected.

The fact that a snake will maintain its hold on its prey and pass with it literally into the jaws of death, is explainable on the ground that when the swallowing process has commenced, a mechanical continuation of it apparently follows. The muscular action once started may be beyond the control of the snake, unless some physical hurt or distraction results in an act of disgorging. A snake that shares a feast with another and in the course of the banquet devours its fellow, passes from frog skin, or in more extreme cases from hair or fur, to snake skin without giving evidence of any interruption of the swallowing process. Perhaps it is unaware of the change of substance or does not permit such distinctions to interfere with its preoccupation, or again it may be that it cannot check the action that has been started.

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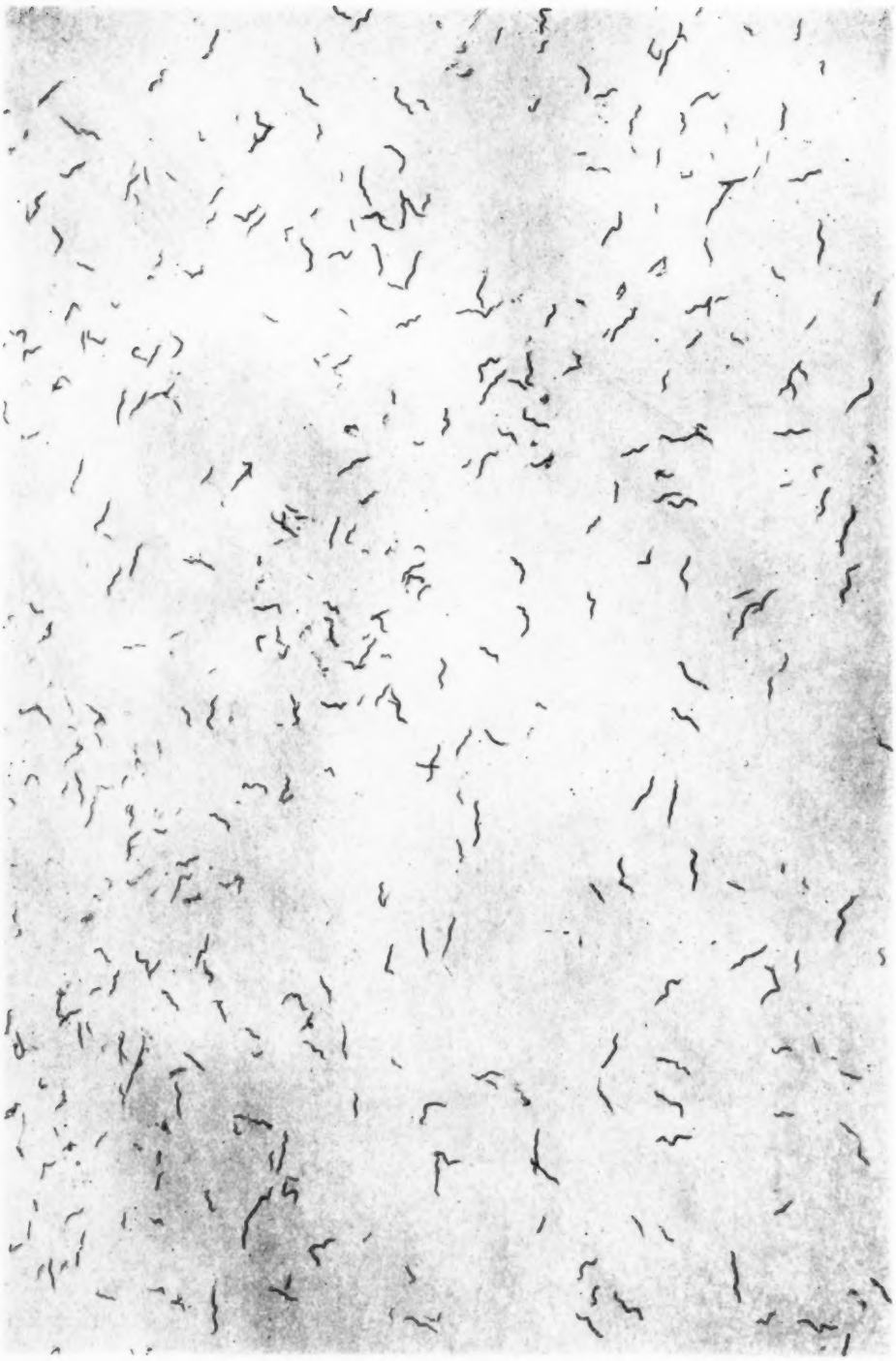

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SNOW WORMS ON THE SNOW

The surface of snow shown is only a small patch in a continuous white stretch more than a quarter of a mile in extent over which the worms were thickly strewn. This photograph was made about June 1, 1907, in a pass on the slopes of Mount Olympus, Washington, and is reproduced herein through the kindness of Mr. Asahel Curtis of Seattle

Snow Worms

ENCHYTRÆID WORMS FOUND IN THE SNOW AND ON THE GLACIERS OF HIGH MOUNTAINS

By E. W. GUDGER
Associate in Ichthyology, American Museum

IN the spring of 1922, a lecture on the scenic grandeur of our Pacific Northwest was given at the American Museum. I had heard that the picture which forms the frontispiece of this article was to be shown under the designation "snow eels." At that time I was collecting data for an article[1] on "Rains of Fishes," and from what I had heard about this picture, I thought that these "eels" must have been rained down. I attended the lecture and met the speaker. Although this gentleman could give me no first-hand information, he told me that he had secured the slide from Mr. Asahel Curtis of Seattle, and that he understood that the phenomenon it recorded was not of uncommon occurrence on the snows of the mountains of Oregon and Washington. I at once got into communication with Mr. Curtis, who in answering my letter sent me a copy of the photograph, with permission to reproduce it in an article. He also authorized me to make use of the data which he gave me. He wrote as follows:

> I made this photograph in 1907 on Dodwell-Rixon Pass, elevation 5200 feet. This pass is at the headwaters of the Elwha and the Queets [rivers] near Mount Olympus. It was taken about June 1, but there was still a great deal of snow in the mountains. We had traveled for a distance of at least two miles over the snow in coming up to the pass and on the Queets side there were miles of snow fields. We had no way of knowing the exact depth of snow on the pass, but from my later experiences I should judge that it was about twenty or thirty feet deep.
>
> On first going through the pass, we either did not notice the eels or they were not there, but on returning, something like an hour and a half later, we threaded our way through them for more than a quarter of a mile, and practically all of the way they were strewn as thickly as they are shown in the photograph. I had been walking along for several minutes before it occurred to me that I should take a picture of them. We had been having a hard day's trip and we were all very anxious to make camp as we were quite tired. Therefore, we did not relish the thought of unpacking the camera, but the incident was such that I thought I would do so nevertheless. The next time I saw the eels was in the same valley on Humes Glacier, which comes down from the eastern crags of Mount Olympus. This was in August, 1907, and they were swimming in the pools of ice water on top of the glacier. There was a report in one of the Seattle papers that a man from Alaska brought some down with him and he seemed to think that they were peculiar to Alaska, but they have been reported to me from various parts of the state of Washington.

I then wrote Mr. Curtis, pointing out that eels have fins and are fish and that they could have reached the snow fields only by the aid of whirlwinds and storms. He thereupon sent a second letter explaining that these were not true "eels" but were small worms somewhat resembling angle worms. He suggested that I write Mr. Grant W. Humes at Harrisville, New York, who had been his companion on the trip referred to. Mr. Humes, in reply to my letter, gave me the following very clear-cut account:

> The creature in question is doubtless a *worm*. It is of tiny dimensions, only about five-eighths of an inch long and perhaps one-sixty-fourth of an inch in diameter and is

[1] See NATURAL HISTORY, November-December, 1921, pp. 607–19.

shaped much like an eel, which is quite likely the reason that it has been called so by one or more persons who have photographed these creatures. The worms are always jet black in color and have been observed many times by the writer in a certain pass 5400 feet in altitude—always upon the snow and in countless thousands, perhaps millions. . . . As to where they come from or their purpose on that vast snow field, I have no substantial idea.

The name of Mr. W. Montelius Price of Seattle, another companion of this trip, was also given me by Mr. Curtis. A letter to him brought the kind reply that from the point at which the photograph was taken the snow field, probably varying from twenty-five to one hundred feet in depth, extended out about one-half mile, there to meet the earth and rocks of the mountain-side. This snow field was covered with the small black worms and several birds were flying about and regaling themselves by feeding on them.

This matter struck me as being most extraordinary and I thought that I had chanced upon a brand new thing, a phenomenon absolutely unknown hitherto—but I was soon undeceived. On looking into the literature I found that this bizarre thing had been known for many years. The best account of it is that given in 1899 by Dr. J. Percy Moore of the University of Pennsylvania from specimens studied in 1897.[1] His material had been collected by Mr. Henry G. Bryant upon the snow fields of the Malaspina Glacier, Alaska, in 1897. Doctor Moore quotes from Mr. Bryant's notes as follows:

The snow-worms were first observed a few hundred yards from our first camp, on the edge of the snow mantle of the glacier, which at this time (June 17) extended to within a few miles of the terminal face of the glacier. By the first of August this snow mantle, which in places was six or seven feet in depth, had entirely disappeared, exposing the hard, compact ice of the glacier. The elevation of the first snow-camp referred to was 520 feet above sea level. Here but few specimens of the worms were noted. At our second camp on the snow (elevation 1,260 feet), they were quite abundant in places, as also at our next camp (elevation 1,580 feet), where their presence in large numbers irregularly dispersed presented the appearance of blotches of coarse dust on the snow. Our base-camp was on a small expanse of snow-free ground on the south slope of a range of foothills abutting on the main range at an altitude of 1,750 feet. A few worms were observed on the adjacent snow of the main glacier, at a somewhat lower elevation; but I do not recall seeing any representatives of this species on any of our excursions in the upper snow fields of the region.

During the month of June and early part of July, while the snow is comparatively dry, they appear about four o'clock in the afternoon on the surface and move sluggishly about, their dark color being quite conspicuous against the white background. They remain on the surface during the night; but when the sun appears in the morning they again burrow into the snow. They were widely distributed over the entire snow-field of the glacier, diminishing in numbers toward the edges. There was no uniformity in their dispersion. We did most of our sledging at night, and frequently passed stretches of snow several hundred yards in extent without noticing any specimens, and then would come to irregularly defined areas which seemed to support colonies of them, where the snow showed shadowy, dustlike patches caused by their presence in considerable numbers. As showing their sensitiveness to heat, I frequently observed their active wriggling as soon as a piece of snow containing them was taken in the hand. Later in the season, when the melting is further advanced and the snow saturated with moisture, the worms appear to become more active, and can be observed moving about in the shallow pools and lakelets which form on the surface of the glacier.

When the snow entirely disappeared and the hard ice surface of the glacier appeared, the snow-worms were observed in the water which formed in the narrow crevasses. In

[1]Moore, J. Percy, "A Snow-Inhabiting Enchytræid (*Mesenchytræus solifugus* Emery) Collected by Mr. Henry G. Bryant on the Malaspina Glacier, Alaska." *Proceedings of the Academy of Natural Sciences*, Philadelphia, 1899, Vol. LI, pp. 125–44.

my notes of August 2, I find the following: "Collected some black worms to-day in a crack of the glacier—found them in the water of a high, narrow crevasse. Observed them on the edge of the submerged snow at a depth of five feet below the surface."

However, the publication of Mr. Bryant's notes and Doctor Moore's careful study of the worms had been antedated by Mr. Carlo Emery,[1] who had briefly described material collected on the Malaspina by Dr. Filippo De Filippi of the party of the Duke of the Abruzzi during the same summer. But his account of the habitat of the worms is merely incidental and is wholly lacking in the fullness of data found in the accounts of Mr. Bryant and Mr. Curtis.

Two years later Mr. Emery published a fuller account[2] of these worms, based on Filippi's notes. Filippi found that they appeared in the mornings and afternoons, on foggy days staying later in the mornings and appearing earlier in the afternoons, but were never seen near midday. On bright sunny days Filippi dug as low as fifty centimeters (about twenty inches) in the snow without finding any.

But Emery's account of snow worms on the Malaspina is, in its turn, antedated by a description published in 1893 by Dr. Israel C. Russell,[3] who had conducted an expedition to that glacier in 1891. Doctor Russell's brief note is as follows:

> In the early morning before the sunlight touched the snow its surface was literally covered with small, slim black worms, about an inch long, and having a remarkably snake-like appearance. These creatures were wiggling over the snow in thousands, but as soon as the sun rose and made its warmth felt they disappeared beneath the surface. They are not seen when the temperature is above freezing.

Doctor Russell further stated in a personal letter to Doctor Moore that he had seen similar worms on the snow fields of Mt. Ranier, Washington, thus antedating Mr. Curtis' interesting observation near Mount Olympus, Washington. Doctor Russell's note is the earliest record for the Malaspina, but is not the first record for a glacier. Dr. G. F. Wright[4] in describing the Muir Glacier in 1887, notes the interesting phenomenon that "In the shallower enclosures on the surface [of the ice of the glacier] containing water and a little dirt, worms about as large around as a small knitting needle and an inch long are abundant."

All this is apparently very novel, but it turns out that an essentially identical habit of a worm of the same group had been recorded still earlier. These accounts, dating back to 1884, may be briefly summarized.

In 1884, there was submitted to the celebrated naturalist, Joseph Leidy, a small vial filled with water obtained by melting some natural ice which had been gathered for domestic use from a mill pond in Delaware County, Pennsylvania, and in the minute débris at the bottom of the vial were some small worms *alive*. Next year another sample of water from melted ice was sent him from Morristown, New Jersey, but the worms were dead. However, on Leidy's request, his correspondent sent him a basket of this natural ice. When this ice, which contained a number of air bubbles and water drops, was melted, there were found

[1]Emery, Carlo. "Diagnosi di un nuovo genere o nuova specie di Annellidi della famiglia degli Enchytræidæ." *Atti Reale Accademia Lincei*, Serie Quinta. Roma, 1898. *Rendiconti*, Vol. VII (1st. sem.), pp. 110–11.—"Sur un Oligochete noir des glaciers de l'Alaska." *Bull. Soc. Zool. Suisse*, Genève, 1898.

[2]Emery, Carlo. "On *Melanenchytræus solifugus*" (In Filippo De Filippi: *The Ascent of Mount St. Elias by H. R. H. Prince Luigi Amedeo di Savoia, Duke of the Abruzzi*. London, 1900, p. 224).

[3]Russell, Israel C. "Second Expedition to Mt. Saint Elias in 1891." *13. Ann. Rept. U. S. Geol. Survey*. 1891–92. Washington, 1893, Pt. II. Geology, p. 33.

[4]Wright, G. Frederick. "The Muir Glacier." *Amer Journ. Sci.*, 1887. 3. Ser., Vol. XXXIII, p. 5.

in the water quite a number of small, living, actively moving worms. These were earth-inhabiting oligochæte worms, which had probably been caught and imprisoned in the air bubbles when freezing took place. Leidy comments significantly upon the fact that in the ice they were alive and active, but that they died, presumably of warmth, when the ice was converted into water.[1]

In the summer of 1893, at Woods Hole, Massachusetts, there were brought to Professor Moore fragments of ice cut from a neighboring pond the previous winter, and this ice contained enchytræid worms and air bubbles like those in the ice examined by Leidy. When the ice melted, the worms thawed out and for a time were very lively, but when the water attained the temperature of the room, they all died—it became too warm for them.

It is known that worms of other kinds, as well as the larvæ of certain insects, have occurred in connection with snow and ice, but the accounts are infrequent and the occurrences are probably accidental. The first of these instances that has come to notice is found in the *Scientific American* for 1850.[2] A correspondent, writing from Sangerfield, New York, says that on November 18 during a moderate snowfall, the snow being about four inches deep and the mercury registering 34° Fahrenheit, he noticed numerous ordinary earth worms crawling about on the snow and seemingly perfectly at home. This was in a pasture, and there had recently been a heavy rain, so the writer judged (and probably correctly) that the flooding of their holes had driven the worms to the surface.

In 1886, Warren Knaus[3] recorded the finding at Salina, Kansas, in a block of natural ice of small earthworms, which Professor Verrill identified as belonging to an undescribed oligochæte species, probably an enchytræid. These worms seemed very comfortable in the ice but promptly died when the water from the melted ice reached 60° Fahrenheit. They were about an inch long and light in color. They normally inhabit the mud at the bottom of shallow ponds and when the ponds freeze to the bottom, they are caught up in the ice.

An anonymous writer in the *Scientific American*[4] for 1891 relates that two or three times during the winter of 1890–91, in Randolph County, Virginia, the crust of the snow had been found covered with numerous "worms" resembling ordinary cutworms, or larvæ of certain noctuid moths. The mystery was deepened by the fact that on the occasions mentioned the snow had a good strong crust, seemingly forbidding ascent from below. Later, similar observations were recorded from points in northern New York.

Specimens from the latter region were submitted to the distinguished entomologist, Prof. C. V. Riley, who reported that they were the larvæ of two species,—the one a cutworm, the other the common Pennsylvania soldier-beetle (*Chauliognathus pennsylvanicus*). He added that it is no new thing to find these larvæ on the surface of the snow, and quoted Dr. J. A. Linter in the Forty-first Report of the State Museum, Albany, New York, to the effect that larvæ of *Nephelodes violans*, the cutworm in question, have been found on the snow in Sullivan County, New York, and at Rockville, Ontario.

[1] Leidy, Joseph. "Organisms in Ice." *Proc. Acad. Nat. Sci.* Philadelphia, 1884. Vol. XXXVI, p. 260.—"Worms in Ice." *Ibid*, 1885, Vol. XXXVII, p. 408.

[2] W., P. B. "Worms in Snow." *Scientific American*, 1850. Vol. VI, p. 96.

[3] Knaus, Warren. "Note on an Ice Worm." *Bull. Washburn. Coll. Laby. Nat. Hist.*, Topeka, Kansas, 1886. Vol. I, p. 186.

[4] *Scientific American*. 1891, Vol. LXIV, pp. 116 and 147.

Two more records, and these miscellaneous accounts will be brought to a close. H. Reecker,[1] in July, 1895, found an earthworm, identified as a *Lumbricus*, in a block of natural ice put up in Westphalia, Germany, the previous March. This worm had apparently become occluded in a crevice in the ice when it was packed away and had there remained until released some months later. Alive and active in the ice, it successfully survived the melting process.

In 1896, Emil Sekera[2] found several dozens of specimens of a common meadow-inhabiting earthworm, a *Dendrobæna* (*Allolobophora*), in a fairly thick fragment of ice formed by snow melting and refreezing on a meadow in eastern Bohemia. Mr. Sekera believed that these worms had come up out of their holes on sunny winter days when the snow was melting and were subsequently caught when the melted snow froze. A number of them were found in a cavity of the ice, and seemed not to have suffered from their enforced captivity.

Two questions have already suggested themselves to the thoughtful reader: (1) On what do the enchytræid snow worms feed, and (2) how do they withstand these low temperatures? As to the first, the Arctic explorer, Nordenskiold,[3] in 1886 probably gave the correct answer. He writes of the Greenland ice cap: "With the exception of a few birds [seen] on the return trip, the only animal observed was a worm living on the different species of ice algæ and therefore probably belonging to the fauna of the inland ice." This worm, so far as is known, has never been identified but it is probably an enchytræid.

Further, Mr. Bryant notes that though he found no lichens nor algæ associated with the worms on the Malaspina, yet he saw near them patches of the "red snow" so common in high latitudes. As is well known, this "red snow" is due to the presence of the red or resting stage of the microscopic unicellular alga, *Protococcus nivalis*. There is little doubt that it is upon such minute plants that these snow worms feed. Likewise Filippi, on page 107 of his book (see page 453 of this article) notes that this alga was found in parallel grooves in the snow, at one point forming reddish stripes. This, however, was a long distance from the spot where he collected the worms (see page 91 of his book).

Now let us take up the second question as to how the worms withstand the low temperatures, first considering the geographical distribution of the enchytræid worms. According to Professor Moore, they have been described from Asia, Europe, Greenland, North and South America, and New Zealand. They are, however, most abundant in northern Eurasia, in Siberia, Nova Zembla, Spitzbergen, Norway, and Denmark; in a word, in northern and colder regions. It is true some have been found even within the tropics, but they are comparatively few, and the above general statement holds. In short, the particular worms under consideration are animals which have habituated themselves to and flourish in low temperatures, especially in the snow and ice of Alpine or subarctic glaciers.

It is known that many of the lower invertebrates have a large capacity to resist extinction at low temperatures. Numerous experiments might

[1]Reecker, H. "Ein lebendiger Regenwurm aus dem Eise." *Zool. Anz.* 1896, Bd. XIX, p. 4.
[2]Sekera, Emil. "Noch einmal über lebendige Regenwürmer im Eise." *Zool. Anz.*, 1896, Bd. XIX, p. 159.
[3]Nordenskiold, A. E. *Grönland*. Leipzig, 1886, p. 193.

be quoted, but the following from Professor Moore performed on a not very remote form of worm is more to our purpose. He says:

> During the fall and winter of 1892–3, I kept a large number of living annelids in my bedroom. Among these was an undetermined species of *Limnodrilus*, about thirty specimens of which lived in a tumbler of water. During some of the coldest nights of the winter, when the temperature outside descended nearly to zero, this tumbler remained standing on the sill of a window which was opened for ventilation. In the morning the contents would be a solid lump of ice with a tangled mass of the worms embedded in its center. During the day the ice would thaw and by evening the worms would be actively waving their posterior ends. This alternate freezing and thawing was repeated many times and on one occasion the tumbler was placed in the open air and its contents kept frozen for a week. At the close of the winter all of the worms except three or four were still alive and normal.

Not only do the lower invertebrates comfortably withstand freezing temperatures, but this is true of the lower vertebrates as well. There is a fairly extensive literature recounting the alternate freezings and thawings of fishes which apparently suffer no hurt by the process. This is true also of the Amphibia. The following unpublished incident in my own experience seems to illustrate the point. In preparing for the next day's dissections by a class of students, I etherized a batch of frogs for about two hours. At the end of that period there were no external signs of life. The frogs were then placed in a little water in a large iron pan and this was set out on a fire escape leading from the laboratory. Next morning, when I reached the laboratory at about 8.15, I found the water frozen and the frogs hard and stiff. In order to thaw them out, I placed them in a sink of lukewarm water and went about my other work. Coming back later (as nearly as I can recall, after an hour or more) I found a very lively company of frogs, apparently none the worse for their experience. Some of them had so far recovered that they were able to leap out of the sink and go hopping around the laboratory. All of the frogs had to be etherized afresh.

And so it is with these worms that inhabit the snow fields—they are "just made that way."

Earthquakes

By EDMUND OTIS HOVEY
Curator of Geology and Invertebrate Palæontology, American Museum

GREAT earthquakes rank with severe volcanic eruptions as the most terrifying of all natural phenomena. Usually occurring without recognized warning, not infrequently happening in the night, extremely indefinite as to source, extent, and duration, they fill the mind of one experiencing their destructiveness with the horror of utter helplessness. He feels the "solid ground" in violent motion beneath his feet, but perceives no cause for such motion. He sees massive walls and towers sway to and fro and fall to pieces, but he cannot discern the force which is at work. Danger and destruction are all about him and he knows not where to turn or whither to flee for safety. The magnitude and suddenness of the disaster overwhelm him, and he is foolish in his panic.

Earthquakes have been far more destructive to human life and property than volcanic eruptions have been,[1] although it is difficult to calculate accurately the loss of life involved, and the estimates of the destructiveness of a particular earthquake vary widely. Among the more disastrous shocks have been the following: Sicily, 1693, with possibly 60,000 victims; Peking, China, 1731, (100,000); Lisbon, Portugal, 1755, (from 40,000 to 60,000); Calabria, Italy, 1783, (from 30,000 to 60,000); and Messina-Reggio, Italy, 1908, in which according to the official returns the total loss of life was 77,283. Contrasted with these calamities is the loss of life involved in the great volcanic outbursts of Krakatoa, Dutch East Indies, 1883, which destroyed more than 36,000 lives; Vesuvius, Italy, 1631, (18,000); Mt. Pelé, Martinique, 1902, (29,000) and the Soufrière of St. Vincent, 1902, (1400); and other historic eruptions which took a smaller toll of humanity.

No considerable area on the surface of the globe seems to be entirely stable, but certain regions or zones are much more subject than others to the occurrence of earthquakes. If we examine a map of the world upon which their location has been plotted, we note in the Eastern Hemisphere a broad belt of seismic (earthquake) activity extending from west to east through the Mediterranean Sea, Persia, the southern Himalayas, and the Sumatra-Java group of islands, with a branch zone extending from the southern end of the Caspian Sea northeastward half way across Asia. This zone has furnished more than 53 per cent of the recorded shocks. A seismic belt practically encircles the Pacific Ocean, the principal points in it being the Japanese Archipelago, Alaska, California, Southern Mexico, Central America, and the northern and southern Andes. This "circum-Pacific" or "Andes-Japan-Malay" zone has given rise to 41 per cent of the recorded quakes. In the Western Hemisphere, in addition to a part of the circum-Pacific belt, the West Indies and the mountains of Venezuela have been the location of important earthquakes; for

[1] Since this article was written and while the author is absent in Australia representing not only the American Museum but the Geological Society of America and the New York Academy of Sciences at the Second Pan Pacific Scientific Congress, the disastrous earthquake of Japan has occurred, supplying new evidence of the terrible destructiveness that from time to time accompanies shocks of major importance.—Editor.

instance Jamaica was visited by a great earthquake destroying the city of Port Royal in 1692 and another shock in 1907 laid waste the city of Kingston.

We are in the habit of thinking of eastern North America as being a region free from earthquake shocks, but this is incorrect. New England has experienced about 250 recorded shocks since the Pilgrims landed at Plymouth, and there have been at least four great earthquakes in the eastern half of the continent during the past two and one-half centuries. One of these, which occurred on February 5, 1663, affected the St. Lawrence Valley over an area more than 600 miles long and 300 miles wide according to the *Jesuit Relations*, and the same region was revisited by a disturbance in the second decade of the present century (1914). In 1811–12 heavy quakes occurred in the central portion of the Mississippi Valley, accompanied by considerable subsidence of the earth's crust and the formation of new lakes fifty miles south of the junction of the Ohio and Mississippi Rivers. In 1909 Illinois was shaken so that the inhabitants were much alarmed. The southeastern part of the United States was the center of a heavy earthquake shock on January 4, 1843, the tremors of which were felt at points at least 800 miles apart. On August 31, 1886, occurred the disastrous earthquake at Charleston, South Carolina—a shock which was distinctly felt from New Orleans to Boston and as far west as La Crosse, Wisconsin. Not a building in Charleston wholly escaped injury in this quake and the pecuniary damage was estimated at between $5,000,000 and $6,000,000, but fewer than 100 people lost their lives as a result of the disturbance.

New York City, on the other hand, seems to be a very safe place in which to live, so far as earthquakes are concerned, for no shocks other than a slight tremor in connection with the Charleston earthquake have been felt there during historic time and no evidence exists of any earth disturbance in the region since the great Hudson River fault was made, the last movement along which seems to have occurred in Mesozoic time millions of years ago.

Within the United States, California is the region of the greatest seismic activity, 514 shocks having been catalogued as occurring there between 1850 and 1886, but the number of quakes that actually took place was probably much greater, since the region was sparsely peopled during the early portion of the period and many minor shocks doubtless passed unnoticed. San Francisco alone suffered from 254 quakes in this period. The catalogue in all likelihood has at least twice as many entries now. Since the middle of the nineteenth century there have been eleven severe quakes in California. That of 1868, known as the Mare Island quake, had such a disastrous effect upon San Francisco that serious doubts were entertained as to the advisability of rebuilding the city on the same site, but these fears were soon forgotten and the city rapidly rose again. Building was resumed without much regard to the lessons that might have been learned from the unfortunate experience and later construction apparently failed to take any adequate precautions. On April 18, 1906, four square miles of San Francisco, now grown to a community of 400,000 inhabitants, was devastated by a quake which originated in the

San Andreas fault zone lying only eight miles southwest of the main portion of the city. In San Francisco alone about 400 people are known to have lost their lives in the catastrophe, and buildings and other property to the value of at least $350,000,000 were ruined by the shock or consumed in the fire which followed.

The peninsula upon a part of which San Francisco is built is traversed from southeast to northwest by not less than five known zones along which movement, technically known as "faulting," has occurred again and again. The chief of these zones is the San Andreas, which takes its name from an important lake through which it runs, and it was horizontal movement varying from nine to twenty feet that was the principal cause of the quake. Vertical movement did not exceed two feet at any one place and usually was absent. These five zones all lie in the coastal ranges of mountains, which are composed of a granitic core against which rest extensive beds of Mesozoic and Cenozoic age, upon which in turn lie thick marine Pleistocene and recent strata. The latter are full of the fossil remains of many forms of life that still are to be found in the neighboring ocean.

Mountain building is going on today in California, a fact evidenced not only by the earthquake activities but established by careful instrumental observations. The strains in the earth's crust which are set up by the mountain-building forces slowly accumulate until they finally overcome the resistance of the rock material making up the earth's crust, and rupture results. The sudden freeing of the pent-up forces and the rubbing of the rock on one side of the fracture against that on the other, with all the attendant starting, slipping, and stopping, cause the earth waves which we know as an earthquake. Initial movement may be very slight and the resulting waves are always very small, but the effects produced on buildings may be very serious, just as the light blow of a mallet on a table may cause a ball lying upon it to jump several feet into the air.

In the Sierra Nevada, forming the eastern half of California, earthquakes are likewise frequent. In 1872 there occurred the great Owens Valley quake, which was one of the most severe on record. This was the result of movements in an old fault zone producing cliffs from ten to twenty feet high along a line more than one hundred miles long. Alaska has been the scene of many great earthquakes, one of which near Yakutat Bay in 1899 resulted, it is reported, in the formation of cliffs from twenty-five to forty feet high along its zone of faulting. Similar displacements of the earth's surface have been noted in connection with earthquakes in many other parts of the globe, notably in Japan and in Italy.

All the foregoing earthquakes belong to the great class known as tectonic earthquakes, or those which are a resultant of the action of mountain-building forces. The second great class of shocks are those attending upon volcanic eruptions. A third class consists of those which have been caused by the falling in of the roof of a buried cavity in the rocks. Quakes of the third class have been reported from Switzerland and the Tyrol, but they are always slight in intensity and local in character.

Earthquakes arising from volcanic explosions or associated with eruptions form a much more important subdivision, second in importance only to

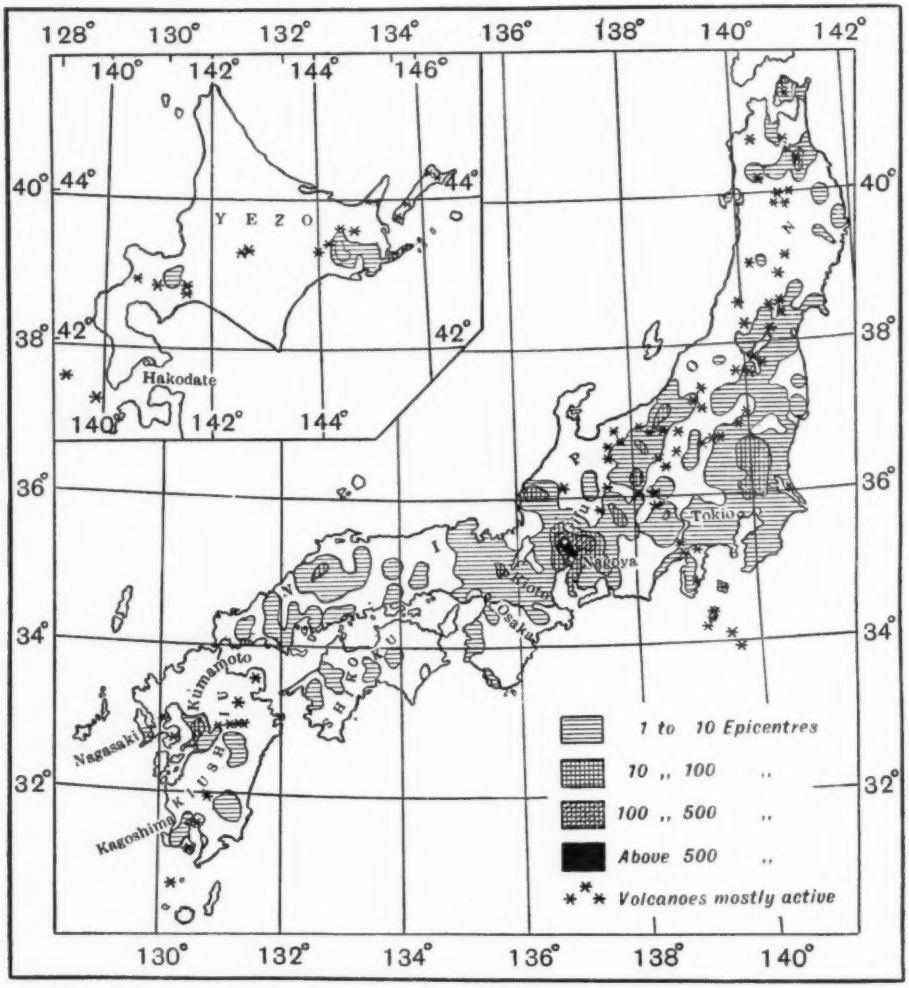
the tectonic earth shocks. Whereas the most violent and destructive earthquakes have centered in non-volcanic regions, the most severe volcanic eruptions of historic times have been unattended by severe earth-shaking shocks and have given rise to quakes of merely local significance. The islands of Martinique and St. Vincent lie within a markedly seismic zone, but the great eruptions of Mt. Pelé and the Soufrière in 1902–03 were free from earthquake shocks, beyond the trembling of the mountains themselves. Vesuvius has been under close observation as a volcano for more than 1800 years, but the earthquakes attending its most severe outbreaks have been local in extent and comparatively light in degree. Casamicciola on the island of Ischia, near Naples, suffered a disastrous volcanic earthquake in 1883, which destroyed much property and between 1700 and 1900 lives. The history of Mt. Etna has been similar; the disturbances which its heaviest eruptions have produced have rarely been felt on the mainland of Calabria across the narrow Strait of Messina. In 1888 the Japanese volcano Bandai-san burst into violent eruption after a thousand years of slumber. Its awakening was attended by a number of moderately severe shocks, none of which was felt, however, beyond a limited area. The famous volcanoes of Mauna Loa and Kilauea on the island of Hawaii have frequent eruptions of the "quiet class," sometimes accompanied by local earthquakes, but the most violent of these quakes, that of April 2, 1868, was scarcely felt at Honolulu, 210 miles distant. The most violent of all recorded volcanic explosions is that which took place in the Strait of Sunda, August 26–7, 1883, when Krakatoa was blown to pieces. This outburst destroyed half of the mountain and left soundings of 160 fathoms where part of the cone had stood. It produced sea waves that affected tide gauges half way round the world; it gave rise to air waves that traveled three times around the globe before they ceased to be distinguishable; and it threw dust into the air to such a height that it remained suspended for months,—but the earthquake shocks produced were strictly local in character and were scarcely felt at Batavia, ninety miles from the crater.

It has not been possible as yet to predict with any degree of accuracy the time when an earthquake will occur. Some regions are subject to frequent shocks while others experience them only at long intervals of time. The frequency of earthquakes, taking into account those of all degrees of severity, is not generally realized. The globe indeed may be said hardly ever to be free from seismic disturbance of some kind somewhere, since the average of all recorded shocks, according to de Montessus de Balloreis more than fifteen per day, and there are between fifty and sixty heavy shocks per year. The bare enumeration by this author of those occurring in 1903 alone fills a book of 600 pages of tabular matter and he has compiled the data pertaining to, and tabulated the position of, 159,781 earthquakes that had been recorded up to the end of 1903.

In addition to the fact that important quakes are the result of mountain-building (tectonic) movements in the earth's crust, they may themselves be the causes of more or less important changes in the surface of the earth. Sharp waves passing through mountain regions have been known to produce landslides, shatter rocks, displace seg-

ments of precipices, open fissures in the soil, or cause subsidence in alluvial regions. Springs, brooks, rivers, and lakes have been formed, altered, or obliterated as a result of earthquake action. Great earthquakes occurring near the borders of the ocean have produced important sea waves, incorrectly called "tidal waves," causing much destruction along the coast and sometimes permanent changes due to erosion and transportation of material. In 1868 a great earthquake sea wave came in at Arica, Chile, and carried the United States warship "Wateree" inland and left her high and dry in the town. A few years later another such wave carried the vessel still farther inland and for many years she was an object of interest to tourists. The great earthquake of November, 1922, off the coast of Chile, was characterized by disastrous sea waves. In February, 1923, a "tidal" wave arrived at Hilo on the coast of Hawaii in seven crests each said to be fifteen feet high, which caused ten deaths and did much damage, but the wave was scarcely felt at Honolulu on the island of Oahu, 210 miles away. The magnitude of these waves in the open ocean is probably to be measured in inches,—they attain destructive size only when they enter the shallow waters near the coast. The recent report of the captain of a steamer that he met a "tidal" wave 115 feet high (the height of a twelve story building) rising from a calm sea hundreds of miles from land may be set down as inaccurate, to say the least.

During the past twenty years the study of earthquakes by means of instruments has spread widely, and observing stations have been established in many parts of the world. The instruments used are called seismographs and all work upon the principle that a heavy mass of iron or other material properly suspended above the earth will tend to remain stationary when earth waves pass beneath it. The apparatus at the American Museum consists of two such heavy masses of iron so arranged that one is sensitive to waves arriving from the east or the west and the other to those coming from the north or the south. The earth waves are very minute and each part of the machine is provided with a system of levers which amplify their effect and with a needle for recording it. A sheet of smoked paper is drawn by clockwork under the needle, which makes a straight white line when no earth wave is passing. When an earthquake wave arrives, the needle begins to swing to right and left and to make a wavy line, from the study of which the observer can calculate the severity of the quake and its distance from the station. Time is accurately recorded on the same sheet of paper by means of a marking device operated by a clock of special design. Most seismograph stations are equipped with apparatus like that at the Museum or a modification of it, but the exact location of the center of an earth disturbance cannot be determined from a single station. Observations from at least three stations situated at the points of a great triangle must be obtained and carefully compared. Apparatus for determining the location of the point of origin of an earthquake from a single station has been devised by Prince Galitzin of Russia, but the method is too complicated for ordinary use and it has not been adopted to any extent, if at all, by seismologists.



Davison's seismic map of Japan, based on Milne's list of 8331 earthquakes for the eight years 1885-92 inclusive, shows that the number of earthquakes recorded in the Tokio district during this period was less than ten; also that the 88 volcanoes are distributed throughout the mid-western portion of the islands, except the Fuji chain to the southwest of Tokio

The Japanese Earthquake Explained

By CHESTER A. REEDS

Associate Curator of Invertebrate Paleontology, and Observer, in Charge of the Seismograph, American Museum

At noon on Saturday, September 1, 1923, Tokio time, the Empire of the Rising Sun was stricken by a power beyond human control. A violent earthquake shook Tokio, Yokohama, Yokosuka, Odawara, Hakone, Chiba, and other points about the Bay of Tokio. Shortly thereafter fires arose in Tokio and Yokohama and almost entirely destroyed those cities. Seismic sea waves were also reported in some dispatches and contradicted in others. At any rate, the devastated region was completely isolated from the rest of the world for days. There were more than 3,000,000 people in the stricken zone at the time of the catastrophe and the

loss of life and property was so great that even a week or more after its occurrence, reports were still far from being complete.

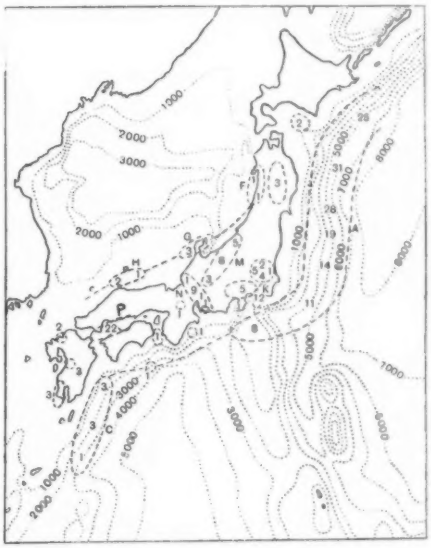
This great earthquake was registered on seismograph instruments on the opposite side of the earth and at intermediate stations. The arrival of the first set of earth waves in the eastern part of the United States was registered at 10:12 P.M., Friday evening, August 31, the main waves shortly before 11 o'clock, and the last waves at 3 A.M., September 1. It may be stated here that due to the recognition of the international date line along the 180th meridian, the corresponding time in New York and Washington was Friday, and due to the difference in longitude of ten hours the time here was 10 P.M., August 31, 1923. Some dispatches state that in Tokio the initial heavy shock lasted not more than six minutes. Whatever may have been the brief duration, the waves which arose from this shock were spread out for five hours on the seismographs in the eastern part of the United States. According to dispatches from the Imperial Meteorological Station more than a thousand "after-shocks," which were not recorded on distant seismographs, accompanied this quake.

The earthquake map[1] of Japan prepared by Dr. Charles Davison in 1921, and reproduced on p. 462, exhibits in a striking manner the earthquake and non-earthquake regions as well as the location of the eighty-eight volcanoes on or near the principal islands of Japan. This map indicates that the central portions of Japan, where active volcanoes are numerous, are singularly free from earthquakes, the earthquake areas being represented by the more darkly shaded districts.

[1]Davison, C. *A Manual of Seismology*, 1921, Cambridge University Press.

A perusal of Prof. John Milne's catalogue of Japanese earthquakes, in which 8331 are listed between the years 1885 and 1892, shows that to every quake that was volcanic there were five that were non-volcanic.

The Japanese Islands form an arc or festoon with the convex side facing the



Map after Omori, showing by broken line ovals and numbers the location of 257 strong earthquakes from 1885-1905; also the depth of the sea in meters about Japan (dotted lines)

Pacific Ocean. Furthermore, the submarine features are of special interest. From the contour lines for each thousand meters in depth (the dotted lines on the map shown on this page) it may be observed that the Japanese Sea is shallow, with its greatest depth a little over 3000 meters. The Pacific Ocean, on the other hand, is very deep. The extraordinary basin called the Tuscarora Deep reaches a depth of 8000 meters at distances of from 110 to 240 miles from the coasts. The gradient is unusually steep, being 1 in 27 off the coast of Nemuro, a maritime village on the island of Yezo, 1 in 30 off the northeast coast of Hondo,

or the main island, and 1 in 16 (to a depth of 3000 meters) off the southeast coast of Kazusa and Awa, near Tokio.

Prof. F. Omori, the Japanese earthquake specialist, has listed 221 destructive earthquakes in Japan occurring from the fifth century to the present. Of the total number, 114 originated inland, 47 under the Pacific Ocean, 17 under the sea of Japan, 2 under the inland seas, while the epicenters of 41 earthquakes are unknown. Of these earthquakes 10 were very violent: 3 of them occurred in central Japan, and 7 originated off the southeast coast, each of the latter being accompanied by seismic sea waves. During the same period there were 23 great sea waves on the Pacific coast and only 5 on the Japan Sea.

Similar results followed from Omori's examination of recent strong Japanese earthquakes. From 1885, when the systematic observation of earthquakes was begun, to 1905 there originated in or around Japan 257 earthquakes, some of which were destructive while the rest, although not involving great loss, were nevertheless strong or moderate shocks each having disturbed land areas of more than 25,000 square miles. The principal regions of these strong shocks are represented by the broken line ovals on the map on p. 463. During the twenty-one years referred to, 138 earthquakes originated in the region A, 7 in the region B, 2 in F, 4 in G, 3 in H, 12 in K, 16 in M, 12 in N, and 23 in P, the references being to the above-mentioned map. The most active region at present is thus that marked A, stretching off the east coast of Yezo and Hondo, the number of earthquakes which occurred in it being rather more than half the total number in Japan. It is no great surprise, therefore, to find that the violent earthquake of September 1, 1923, took place in the Tokio district near the steep Pacific side.

An earthquake has been explained as the result of any sudden displacement within the earth's crust. It may have a tectonic or a volcanic origin. Tectonic earthquakes are due as a rule to the displacements which effect the growth of faults or fractures in the earth's surface. Volcanic earthquakes may be considered as those which are caused by volcanic eruptions or displacements along fractures of the volcanic mass, whether the volcano be active, dormant, or extinct. Thus volcanic earthquakes are of two kinds: first, those which are purely volcanic in their origin, and second, those which are somewhat tectonic in character.

From seismograms taken on certain active volcanoes of Japan, Omori divides the volcanic earthquakes into two groups: (1) those due to earthquakes which were not accompanied by any outburst of the volcano, and (2) those due to earthquakes which were invariably coincident with the explosions. The first group consisted only of simple quake vibrations; the second group began with slow tremors on which, after a few seconds, quick vibrations were superimposed. The earthquakes without explosions were distinctly the stronger, for of the 14,085 shocks of this character recorded from 1911–16, 21% were sensible, while of the 8847 earthquakes with explosions only 0.3% were sensible.

Tectonic earthquakes, the greatest of all, occur in regions somewhat distant from volcanoes or far removed from present or past volcanic action. They are due either to displacements along faults or to the warping of surface beds of rock in the earth's crust. As might be expected, faulting

(the slipping of adjacent blocks of the earth's crust on one another along a fault-plane or fracture) predominates over warping in producing earthquakes. The connection between the crustal deformations and the earthquakes is shown by the coincidence between their times of occurrence and the areas affected by them. It is important, however, to notice that the deformations are not consequences of the earthquakes but rather the primary causes of the earthquakes. The number of earthquakes accompanied by crustal deformation is considerable. In many cases, however, the observations recorded add little to our knowledge beyond the fact that some movement usually of elevation has taken place. The principal reasons for connecting earthquakes with fault slips are the following: (1) with every step in the growth of the fault it is evident that an earthquake must occur; (2) in some great earthquakes the fault displacements are manifest; (3) in all but the weakest earthquakes the areas of greatest disturbance are elongated in form, their longer axes being parallel to the fault lines of the district; (4) the number of earthquakes in any region far exceeds the number of the faults; (5) in a series of associated earthquakes the center of the disturbance migrates to and fro in the direction of the fault; and (6) owing to the variations in the volume and displacement of the rock mass, fault slips are capable of producing the weakest tremor as well as the most violent shock.

The displacements along a fault may be almost entirely horizontal or almost entirely vertical, but in most cases they are both horizontal and vertical. Horizontal displacements are usually manifested by the relative shifting of objects previously in contact or in line; vertical displacements by the formation of fault scarps.

The great earthquakes which remove over-strained conditions in the earth's crusts occur after short lapses of time at different places in the seismic belt or related earthquake zones. They seldom, if ever, recur at one or the same spot, for the earth's stresses, having been temporarily adjusted at that place, accumulate in the adjacent seismic regions. Thus the Japanese earthquake of December 23, 1854, took place off the coast of Tokaido, while the equally extensive shock on the next day originated from the same earthquake zone 200 miles to the west, off the coast of Nankaido. Similarly sympathetic stresses accumulating in widely separated parts of the Pacific seismic zone have been noted as follows:

(1) Off the northwest coast of Alaska in 1899.

(2) Mexico and Central America, 1900 and 1902.

(3) Panama, Colombia, and Ecuador, February 1, 1906.

(4) San Francisco, April 18, 1906.

(5) Aleutian Archipelago, August 16, 1906.

(6) Valparaiso, August 16, 1906.

(Note that Nos. 5 and 6 occurred on the same date, No. 5 occurring half an hour earlier than No. 6.)

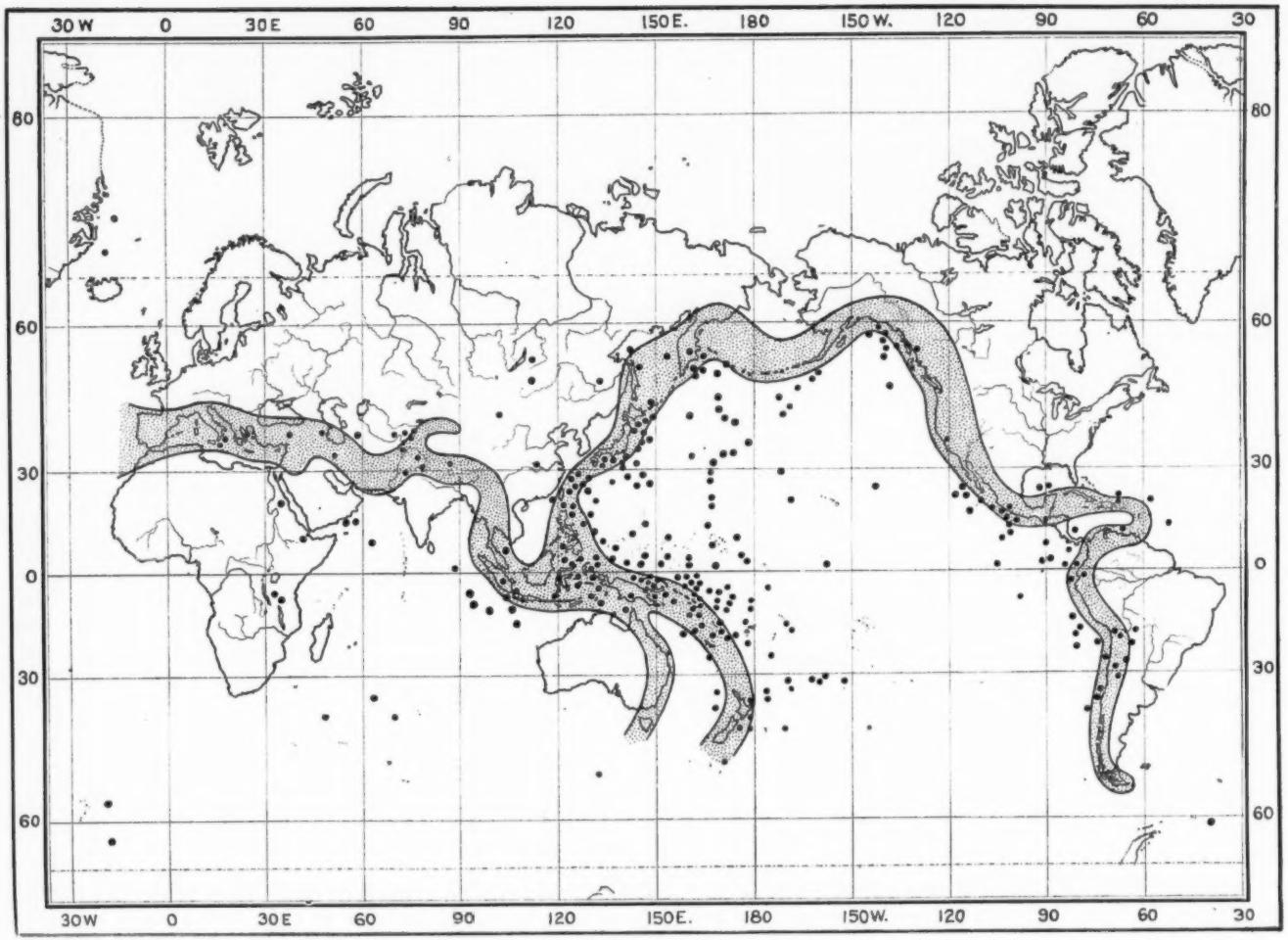
(7) Chile, November 11, 1922.

(8) Six hundred miles northwest of San Francisco on the line of the San Andreas fault, January 31, 1923.

(9) South Pacific Ocean, February 3, 1923.

In this connection it is interesting to note that after the great Japanese earthquake of September 1, 1923, a sympathetic quake occurred in Calcutta, India, on September 10, and another one in Paotingfu, China, September 14, 1923.

A larger view of the problem is necessary in order to understand some of the underlying causes of the recent Japanese



SEISMIC MAP OF THE WORLD

During the period 1899 to 1911 there were 276 major earthquakes which were sufficiently severe to be recorded at all seismological stations scattered over the world. Their epicenters are shown on the adjacent map as heavy dots. During the same period 679 additional earthquakes were recorded whose waves reached only one half way around the earth. Their points of origin (not shown) had a distribution similar to that of the major quakes, particularily in the region of Japan.

The close association of recent earthquakes to the belts of sedimentation, dominant folding, and mountain uplift (shaded zones) during recent geologic time (Cenozoic era) is very marked

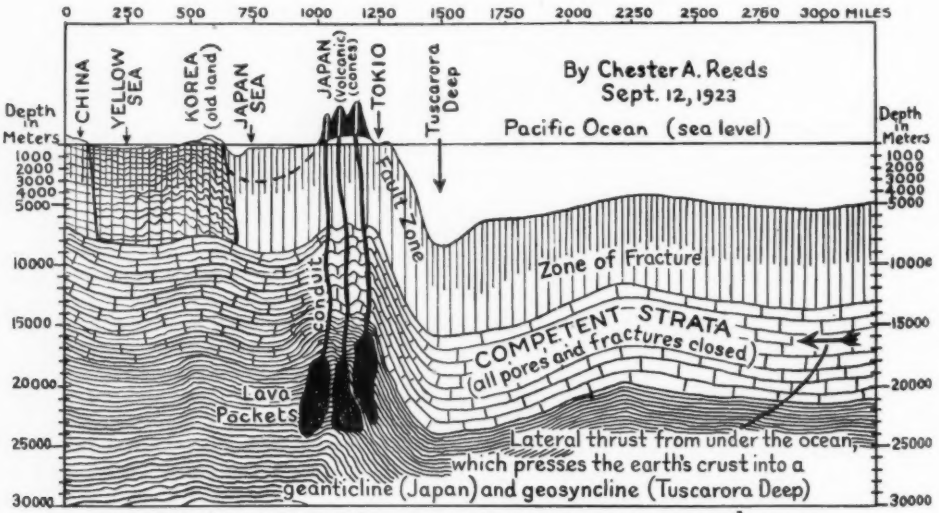
earthquake and of other earthquakes. In the distribution of earthquakes are to be found the loci of the most pronounced earth movements today, that is, the zones of present maximum change in the strained figure of the lithosphere, or solid part of the earth. In the case of the continental areas we have long known the position of the earthquake districts. The earth's crust trembles predominantly along two narrow zones which lie along two great circles of the earth known as the Mediterranean, or Alpine-Caucasian-Himalayan circle, and the circum-Pacific, or Andean-Japanese-Malayan circle. As to parts of the ocean floor which have been affected by these movements, it is only during the present generation that methods have been perfected for locating the sites of earthquakes beneath the seas. Modern seismographs, or earthquake-registering instruments, now record the sudden major movements of the earth's surface quite independent of whether they occur at the bottom of the sea, upon distant islands, or upon the continents. The centers of large earthquakes, determined by the late Prof. John Milne for some fifty odd stations of the British Association for the years 1899 to 1911, have been entered as heavy dots on the map on p. 466. It will be noted that the continental earthquake districts are extended outward for a distance on the floor of the neighboring ocean and that the disturbances are greater in number for the undersea areas and belts of festooned archipelagoes east and southeast of Asia.

It may be noted further that the two main seismic belts are closely related to the geosynclines, or areas of sedimentation, dominant folding, and uplift during Cenozoic time, that is, during the last era into which geologists divide geologic time. This area may represent a period starting 3,000,000 years or more ago and continuing down to the present. The areas of dominant folding and uplift during Cenozoic time, as outlined by Prof. Charles Schuchert in 1915, have been superimposed as shaded zones, on the accompanying map of the world. From a careful examination of this map alongside that of a modern atlas, it may be observed that these two major circles of earthquake disturbance include within their limits the arcuate mountain folds known as the Pyrenees, Alps, Carpathians, Caucasians, and Himalayas of Eurasia and the Cascadian and Andean mountain systems of North and South America. These great mountain masses stand before us today as the most lofty mountains of the world. They began their existence in the early part of the Cenozoic era and from their grandeur we might judge that they are almost completed, but from the rather frequent earthquakes that occur in and about them we must conclude that the earth forces which built them are still active although in their relative maturity. The mountains themselves are young and although not all of them are in the same stage of development, they are in their prime. The festooned island groups, however, such as the Japanese archipelagoes and similar arcuate forms off the southeast coast of Asia, as well as the Aleutian and West Indian arcs, represent younger mountain chains of late Cenozoic age which are not yet fully exposed but are rising from the floor of the ocean.

A modern atlas with the depths of the sea indicated, such as Andre's or Stieler's, shows that these festooned archipelagoes of the Pacific are characterized by generally narrow deep troughlike depressions on the ocean

side. For instance, just east of the Philippines one of these troughs is 9788 meters deep, that is, a little more than six miles of depth. The figure on this page represents an east-west vertical section of the Japanese area in the latitude of Tokio, Japan. The section extends eastward from the coast of China across the Yellow Sea, the tip of Korea, the Japan Sea, the main island of Japan, the great Tuscarora trough, and some 2000 miles of the Pacific Ocean. The most striking features of this cross section are the folds that have been developed in the earth's crust. In geologic terms the elongated Tuscarora "fore-deep" represents a syncline, while the rising mountain range represents the associated anticline. These folds have been developed by a compressive force coming from the more central areas of the Pacific and applied laterally to the competent stratum, which abuts against the older and more settled land of Asia. This idea of folding may be simply demonstrated by holding one margin of a large sheet of paper firmly in position; then by pressing laterally on the opposite margin the anticlinal and synclinal folds will appear. This hidden geologic force which produced the folds still continues to act. It arises no doubt from the downward movement or sinking of certain portions of the lithosphere beneath the Pacific Ocean.

According to Prof. W. H. Hobbs, the development of such folds is responsible for the formation of pockets of molten magma from shale beds lying beneath the competent strata in the vicinity of the anticlines as noted in the cross section. Magma pockets situated in this position give rise to the lava of the volcanoes scattered through the western portion of the principal islands of Japan, the chains of volcanic islands to the north and southward, as well as those of other mountain belts situated in the seismic zones of the earth. The volcanoes seem to arise from the back of the anticlinal folds throughout their arc-shaped extent, while the majority of the earthquakes are developed on



DIAGRAMMATIC EAST-WEST CROSS SECTION OF THE EARTH'S CRUST IN THE LATITUDE OF TOKIO, JAPAN

the steeply sloping or trough side of the fold, for it is on this side that the rocks are under the greater tensional and compressive stresses. In this belt movements in the earth's surface do not take place uniformly, for stresses which tend to produce such movements are resisted until they have accumulated sufficiently to overcome the resistance offered by the stiff rocks. Thereupon partial relief is obtained suddenly by initial faulting or subsequent slipping of earth blocks on previously developed faults, causing earthquakes. Minor adjustments following shortly after are referred to as after-shocks.

Thus it may be noted that Japan, the land of "cherry blossoms," is an island empire rising out of the sea. To most Americans Japan presents a detached group of mountainous islands beset with numerous volcanoes and frequented by earthquakes. The oceanic waters which surround these islands hide from view the stupendous mountain topography and the structure which powerful earth forces have already built up and which they are still erecting off the coast of Asia. To the writer the young mountain piles which have reared their crests miles above the sea and which are admired in all their grandeur, such as the Himalayas and the Andes, stand as mute guide posts pointing toward the younger generation of mountains which, although for the most part still submerged, are rising along the margin of the Pacific Ocean. Volcanoes and earthquakes are associated with the forces that build mountains, for they perform very much the same function that safety valves do on a steam locomotive. For centuries Japan has had destructive earthquakes. Omori, who has studied many of them, concludes that the maximum epochs of destructive activity recur on an average every 13 or 14 years. From the nature of the case we may thus conclude that earthquakes will occur in Japan at rather frequent intervals for centuries to come. This prophecy, however, should not dishearten the Japanese nation, for, besides its own progressive development, it can take courage from the fact that the Babylonian, Egyptian, Grecian, and Roman civilizations, developed about the Mediterranean, despite the fact that this region lies in one of the active seismic belts of the world.

The Japanese nation is fully aware of its acute situation, for in accordance with an Imperial Ordinance dated June 25, 1892, the famous Earthquake Investigation Committee of Japan was organized. Its objects were stated to be: "In the first place to investigate whether there are any means of predicting earthquakes; and in the second place to investigate what can be done to reduce the disastrous effects of earthquake shocks to a minimum, by the choice of proper structures, materials, positions, etc." The Committee has included some of the most brilliant men of Japan and other lands and has now worked enthusiastically and tirelessly for a period of thirty years; but it is necessary to admit that no method of forecasting earthquakes has been discovered and that the second endeavor is the only one which had been crowned with some measure of success.

A REDDISH EGRET

The graceful postures assumed by these birds and the beautiful curvatures that result from their ever-changing attitudes may well kindle the admiration of the beholder

Louisiana Herons and Reddish Egrets at Home

A VISIT TO GREEN ISLAND, OFF THE COAST OF TEXAS

By ALVIN R. CAHN
University of Illinois

PICTURE, if you will, a long narrow expanse of wind-blown sand piled in great undulating wavy hills, fading into the horizon to the north and south. Here and there, black against the moonlit background, clustered groups of mesquite trees throw blacker shadows on the sand. On the top of one of these sand hills stands a lone figure, silhouetted against a rising moon: a booted figure, with a large hat, belted waist, and a cutlass catching the moonbeams. From his vantage point he looks to the east over the waters of the Gulf of Mexico; to the west over the sands of Padre Island to the placid Laguna de la Madre. A massive ship in full rigging, sails furled, rides at anchor in the Gulf. A small boat, propelled by massive figures at the oars, plies between the ship and the island. Half-naked figures leap from the boat as it grinds on the beach and lift from it caskets bound in metal, which they shoulder and carry to land and across the few hundred yards of sand to the water on the west. Here the caskets are deposited in a smaller boat, manned by the lone sentinel from the hill and a single oarsman who pulls out toward a small black spot lying between them and the mainland of the Texas coast. Hours later the boat returns, but with a single occupant, the watcher from the hill, who crosses the island and is hurriedly rowed to the ship. With the moon declining in the west the great ship unfurls sail and slowly heads eastward, to disappear in the gray mists of morning, never to be heard from again.

Years pass over the scene of the buried treasure. Romantic adventurers, hearing the tradition of the buried riches, visit the island, which is now covered with a tangled mass of vegetation, making it conspicuous among the islands in the Laguna Madre and entitling it to the name of Isla Verde, and lives and fortunes are spent in frantic endeavor to recover the pirate captain's buried gold. But Green Island or Isla Verde guards well its secret—if indeed it has one—and the treasure still remains hidden, ramparted now by an almost impenetrable entanglement of *Yucca*, *Condalia*, and prickly-pear cactus, and sentineled by an ever-active host of graceful birds on the wing.

Such is the tradition of Green Island, which lies in the Laguna Madre, off the coast of Texas, about thirty miles north of Point Isabel, and about an equal distance south of Bird Island, the wonderful breeding ground of the brown pelican, which I visited in 1921.[1] With the coming of spring in 1922 came also much interesting and tantalizing information regarding a great heron and egret colony on this romantic island. With the memory of the previous trip still fresh in our minds, it was not a difficult task to reorganize my little party of the preceding spring and hie away to further photographic efforts in a new field.

We were met at Brownsville, Texas, by Mr. R. D. Camp, the warden of the region and the guardian angel of the

[1]The reader is referred to the article entitled "Brown Pelicans at Home," by Alvin R. Cahn, NATURAL HISTORY, September-October, 1922, pp. 416–29.

breeding birds on Isla Verde. During the entire breeding season and until the greater number of the young are well out of the nest, Mr. Camp lives in a houseboat anchored just off the island, and his presence, backed by a great sign erected by the National Association of Audubon Societies, throws a charmed circle about this newly designated bird sanctuary. It was only the hospitality of Mr. Camp that made my trip possible, as Green Island is very inaccessible and if its shores be reached, very inhospitable.

By auto—a rickety Ford that was suffering from asthma in at least two cylinders, driven by a Mexican who knew as much about machinery as a native Hottentot—we rattled across the great dusty waste country lying between Brownsville and Point Isabel on the coast. Timid sparrows flitted occasionally between the scattered tussocks of grass; wandering burros watched us suspiciously; a lone coyote crossed our path and trotted leisurely away. The rest of the picture was an unending horizon that stretched, an unbroken line, through 360 degrees of space. Once, near noon, a mirage appeared for a few moments, revealing a series of hills overgrown with trees, and water about the foot of the hills. Then the horizon closed in once more. A stiff breeze was blowing off the gulf, and the salt air filled our lungs. After three hours of driving and detouring to avoid bottomless mud puddles left over from the heavy rains of the previous week, we reached the Point, rattled up to the wharf and unloaded. We were at once surrounded by the greater part of the population—about an equal proportion of burros and pigs and an occasional Mexican. The Mexicans and burros were satisfied to watch us passively, but the razorbacks announced their presence by attacking *en masse* and carrying off our food stuffs in every possible direction. We finally reassembled our belongings and loaded them into a fishing boat which was engaged to take us to the island. Up went the sail, and we were soon dancing merrily over the waves before a favorable wind.

During the five hours that passed before we reached Green Island we watched the slowly changing panorama of distant land unfold and drank luxuriously of the salt air. The Laguna Madre is quite wide in this region, and during most of the trip Padre Island was either entirely below the horizon or appeared as widely separated golden points, hazy in the distance. There was very little life in evidence; mixed flocks of sandpipers hunted along the shores; an occasional laughing gull passed by; black skimmers cut the water about us and were away again to their prospective breeding grounds at some place along the sandy beaches: a thin line of white foam, piled up on the shore of a distant island, proved under the scrutiny of my binoculars to be a colony of white pelicans resting at the water's edge. Ward herons flapped slowly by, heading for the mainland, and still others could be seen through the glasses, standing knee-deep in the shallow water fully half a mile from shore. Once a porpoise undulated across our path and was seen for a few moments as it sought the deeper water of the main channel to the east. Innumerable mullets broke water, shooting straight up into the air eighteen inches or more, apparitions of glistening silver, to fall back again with a splash that sent the spray dancing in the sunlight. It was very hot. The blinding glitter of the water, the merciless glare that enfolded us from all

sides made the constantly shifting patch of shade cast by the sail the nearest thing to comfort we possessed in our crowded quarters. In fact, it soon became so excessively hot that it was necessary for us to shift our positions repeatedly in order to avoid painful blistering of exposed skin. The hours slipped dreamily past until finally, at about four o'clock, Green Island was sighted, a mere speck on the horizon. Because of the gradual dying down of the wind, it was nearly two hours before we were able at last to tie our skiff to the stake from which our houseboat drifted at the end of a heavy rope.

As twilight was nearly upon us, I did not visit the island that night, but contented myself with sitting on the roof of the houseboat and scanning the island through my binoculars. The island rises from a great mud flat, which disappears completely during times of high water, leaving only a narrow sand beach, beyond which begins the vegetation. To the northeast the island rises at a gentle incline to a height of about fifteen feet, to drop off again as an almost perpendicular cliff to the sand beach and mud flat. Much of this flat was out of water, and hundreds of reddish egrets, together with Louisiana and Ward herons, were wading in the shallow water. Here and there among the green tangles of the island I could pick out momentarily the site where a nest must be, as egret or heron appeared for a few seconds outlined against the dark background. Overhead a constant stream of reddish egrets and Louisiana herons winged their way to and from the island in their customary twilight activity. Dozens of great-tailed grackles mixed with the general migration, clucking in familiar blackbird fashion. A few least terns were busy along the beach, where they had their shallow nests on top of the sandy windrow, and a pair of skimmers dipped past me, calling hoarsely. From high above a black vulture circled slowly down and settled on the only dead tree upon the island. From my perch on the roof I could see that there were a good many birds on the island, but I thought Mr. Camp a little optimistic when he said that there were thousands of breeding birds awaiting my visit on the morrow. However, I was soon to be convinced that he was not exaggerating things in the least!

The next morning was spent in a general survey of the island and in the enjoyment of a truly astonishing sight. Wherever we went, we were preceded by a wild activity on the part of hundreds of egrets and herons, which rose in great clouds before us and settled near by upon the tops of the shrubs, surveying us uncertainly.

As far as the eye could reach the bush tops were alive with graceful forms. Reddish egrets and Louisiana herons were everywhere, the marvelous grace of their ever-changing postures exciting constant wonderment. In a far corner a few pair of black-crowned night herons had their nests hidden in a particularly dense thicket, and appeared for a moment only as they hurriedly escaped at our least approach. Ward herons sprang from their nests with a great squawk as we advanced, and disappeared on heavy wings over our limited horizon. Here and there in the heart of the tangle we could get a glimpse of a secretive form of wondrous white as some snowy egret or reddish egret in the immaculate plumage of the white phase slipped silently from a hidden nest. Through the underbrush we could see also the black sleek forms of the grackles as they slipped

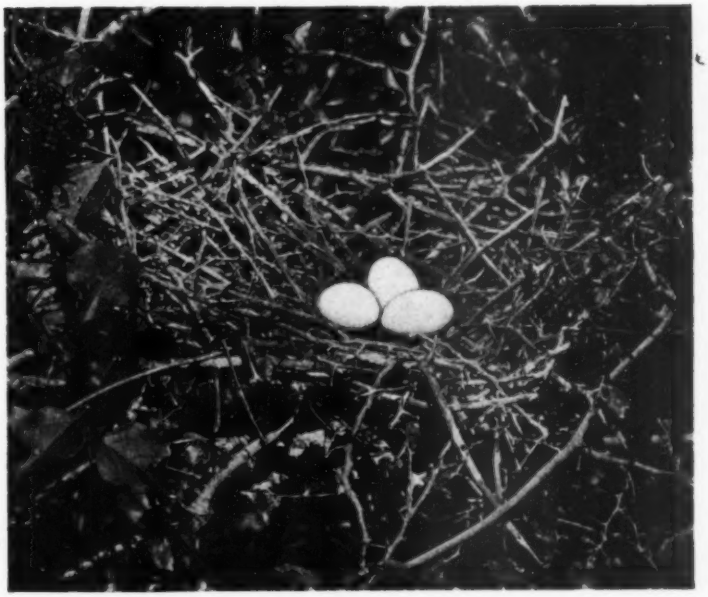
silently from nest to nest, making the most of the absence of incubating egrets and herons to ply their nefarious trade of egg-eating. Frequently, too, one of these large blackbirds would come to the top of some conspicuous perch and there, with much ado, inflate and deflate himself, producing thereby not only a grotesque appearance but also a most peculiar song. From a near-by shrub a gray-tailed cardinal burst into a song of great richness, as if to ridicule the pathetic attempt of the grackle at vocal gymnastics. Everywhere there was life, and everywhere there was beauty and grace and a symphony of sound and color.

On the morning in question our investigations were confined to the outskirts of the vegetation, with excursions along the two paths which Mr. Camp had cut through the brush. It was during this time that I learned the exact nature of the island to which I had come. I had been warned that the vegetation was thick, that there were cacti and "other things" with prickers; that I ought to wear leather trousers, leather gloves, and a leather coat—which would have been utterly impossible because of the heat. I was prepared, therefore, to find a tangled growth on the island, but down in the bottom of my heart I had doubted whether the brush could be as bad as reported. I had not been on the island five minutes, however, before I realized that the great problem in photographing the birds would be to get near them. for this mass of brush in which the birds nest is nothing but a huge pincushion armed with a million needle points, projecting in every direction, at every angle, and at every height. The bushes, some eight or ten feet high, are mostly a vicious species of *Condalia*, exceedingly branched and covered with short, very stiff, very sharp thorns that tear the skin painfully and cling to the clothing in a most annoying fashion. Among the *Condalia* are scattered luxuriant examples of the famous *Yucca*, or Spanish dagger, which grows about breast high, appearing as a great sheath of long, firm dagger-like leaves tipped with a thorny substance sharper than a Victrola needle. It was one of these villainous thorns that gently pierced my knee cap and made me a very stiff, sick, and unhappy mortal for three days. Beneath the *Yucca* lies a substratum of *Opuntia*, the prickly-pear cactus, running vinelike over the ground, bristling like an angry porcupine, and, porcupine-like, ready to shed hundreds of needles into anything that comes in contact with it. Under the cactus I believe was the ground, though I do not recall ever having seen it! Therefore, before any photographing could be done, it was necessary to bring the machete into play, and slowly, carefully, and very painfully cut paths and by-paths into the thickets and thus clear spaces in which the great ten-foot ladder we had brought along for photographic purposes could be erected near suitable nests. It was from this stepladder that the photographs that accompany this article were taken; without it there could have been no photographs.

Reddish egrets and Louisiana herons predominated, the former being the more abundant. Areas were easily found in which every stage of nest construction and all stages in the development of eggs and young were in progress. Some nests were found in the very first stages of construction; others showed eggs or young, while still others gave evidence that the young had already outgrown the nest and had

The Louisiana heron is a study in grace and poise

A foundation of sticks and twigs would seem to provide rather rough bedding for the nestlings that hatch from the eggs of the Louisiana heron. Much effort is expended in the building of the nest, for it is no easy task to manipulate the long sticks. The number of eggs to a nest averages three, but nests containing as many as four eggs are not unusual



left it for a more adventurous life among the bushes. An explanation of the fact that some nests were just being started was found in the activities of the grackles, which destroy hundreds of eggs of both of these species each year. This havoc is, of course, wrought during the absence of the old birds, and the grackles show an astonishing ability to single out unincubated eggs. During my visit I saw dozens of eggs that were being eaten, but in no case had incubation been in progress more than a few days.

The great-tailed grackle destroys the eggs of both the Louisiana heron and the reddish egret. Three eggs of the former species, drained of their contents by one of these pillagers, are shown in the picture

Yet I seriously doubt whether this is a conscious selection by the grackles of unincubated eggs: I believe that the truth lies in the fact that it is during the the time that the egg complement is being laid that the greatest part of the destruction occurs, for it is then that the eggs are left entirely unprotected and the grackles are able to feast long and heartily without interruption. Yet this destruction of the nest causes very little worry to the old birds: indeed, I once watched a grackle break up an egret nest while the parent bird stood not fifteen feet away, intermittently watching the performance and preening its feathers! Soon after the destruction of the old nest, a new one is begun near by, the sticks being taken from deserted nests or from the ground. The nest-building is rather a slow process, because of the awkwardness of handling long sticks in the tangled brush. Often the birds will work for an hour, poking and fussing with one small twig before it is finally placed in just the proper position. These nests may be built at any elevation from the ground to the top of the brush stratum, although only a minority are constructed upon the ground. The average number of eggs to a set is three; many nests were found, however, that contained four eggs.

The life of the young birds is anything but exciting. Day after day they lie on their shallow platform of sticks under the sweltering rays of a June sun, and the monotony of their lives is broken only by the coming and going of the old birds and, as the nestlings grow older, by innocent sparring matches among themselves. Long before they are able to fly, they leave the nest at the approach of danger and, using beak and wings and legs, climb unsteadily about in the brush, returning to the nest when the excitement is over. Before they are able to climb out of the nest, the babies make a valiant defense against an intruder by hissing and jabbing vigorously with their bills. They are so unsteady, however, that they very seldom hit what they are aiming at. They are a comical sight sitting on their heels, their great feet sprawling before them as they vainly endeavor to keep their balance during the violent exercise of defense. Once they become used to climbing about in bushes, they are

safe, as then it is nearly impossible to capture them: they can go through the tangle much faster than you can.

The old birds took very complacently to the terrifying presence of the great ladder with the camera attached to it and in most cases returned to the nest within the hour. The clicking of the shutter was a source of worry for some time, but once the birds grew accustomed to the sound, it became necessary to throw sticks at them or to clap the hands in order to make them leave the nest. At that, they often returned to their incubating while I was still engaged in changing the plate holder less than six feet from the nest. In returning the birds ordinarily alight on a near-by bush, and from it survey the situation leisurely. Then, by a series of hops they slowly approach the nest, usually (in the case of the reddish egret, at least) with the feathers all erect. They will stand at the very edge of the nest sometimes by the hour, simply for the purpose of warding off the supposed attacks of neighboring egrets that are likewise amusing themselves by repelling imagined intrusions. Bristling, with every feather erect, they jab viciously at the object of their attack, or simply endeavor, by a full display of plumage, to overawe the innocent offender. Thus they pass the time defending their nests against entirely theoretical attacks of their neighbors, whose one idea often is simply to slip back to their eggs as unobtrusively as possible. This erecting of the feathers also plays a part during the mating season, the courtship consisting of much twisting and stretching of the neck, accompanied by much bowing and a complete display of feathers. Both the egrets and Louisiana herons are wonderful sights when they fluff themselves to the utmost.

Because of the fact that the heat is so intense, incubation consists of two types. During the late afternoon and early morning and throughout the night the birds sit upon the nest in ordinary fashion. It is during the heat of the day, however, that the problem becomes not one of giving heat to the eggs or young, but of giving shade and air circulation. During the heat of the day, therefore, it was a common sight to see the old birds standing in the center of the nest with the wings extended and drooping like a canopy over the hatching eggs or squirming young. Strange as it may seem, these youngsters are hardier than the young of the brown pelican, which often die apparently of sunstroke if they happen to hatch during the absence of the old birds. The chief source of mortality among the young egrets and herons seems to be falling out of the nest, and a young bird is permitted to die of starvation or to be consumed by the red ants or a stray coyote that may reach the island during low water, right under the nest, without the old birds showing any sign of comprehending what is going on.

In view of the sticky, prickly character of the vegetation one naturally wonders what effect the thorns and daggers have on the birds. The answer is very simple: no effect at all. The birds slide through the tangled undergrowth and promenade over the top of the thorny mass as if there were nothing at all annoying in the character of the vegetation. Nests were found under and in the *Yucca* clumps, where it was impossible for a hand to reach unscratched, nestled in the heart of the *Condalia* bushes, under great twisted groups of cacti bristling like pincushions. On this inhospitable tangle the herons and egrets alight, and over

A reddish egret incubating on a nest that is bastioned by forbidding prickly growths

its uneven surface they hop and flutter without the slightest apparent inconvenience. Their ability to balance themselves is remarkable, and one of the favorite observation posts of the egret is the pinnacle of the fruiting body of the *Yucca*. On this unsteady perch the birds balance themselves even on windy days, and with half-spread wings maintain their equilibrium under the most adverse conditions.

Just where the old birds went for food is a question. On a quiet evening hundreds of them would be seen standing in the shallow water that surrounds their island, but the birds remained almost motionless in the red glow of the setting sun, and there was little evidence that they caught their food so near home. On the contrary, with the approach of evening and the lessening of the intensity of the sun, the birds usually took wing and disappeared in small groups to the southwest, in which direction undoubtedly lay their feeding ground. The food consists of small fish and frogs, tadpoles and an occasional crustacean, which are probably caught in the marshes of the mainland coast. Before dark the birds were all back and at the nest, and there was relatively little night activity. With the daylight the birds would fly away once more to the feeding grounds, returning again before the heat of the sun was sufficiently intense to endanger their precious eggs or babies. Then followed another period of inactivity during which the birds remained close to the nest, preening their wonderful feathers or playing at repelling intruders.

For nearly two weeks we worked on the island, carrying the great ladder from one end of the place to the other when nests suitable for photographic purposes were located, training the cyclopic eye of the camera now on this nest and now on that, as series after series of pictures were taken. For nearly two weeks the wind blew out of the south, a heavy gusty wind that kept the bushes and birds in nearly constant motion and added untold difficulties to the natural obstacles that already existed upon the island. Rain squalls blew up from the gulf without warning, and drifting cloud masses obscured the sun at unexpected and often critical moments, making the task of photographing the birds as difficult as possible. Torn by *Condalia*, stiff and sore from the *Yucca* jabs, our legs bristling with cactus thorns even as a cactus, bathed in sweat and burned into a nearly unsleepable condition by the merciless sun, we shot picture after picture in this wonderful natural studio. It was my desire to bring back with me life-history studies telling the story of the home life of these two most interesting species, the reddish egret and the Louisiana heron. As it was impossible in the cramped quarters of the houseboat to do any developing, day after day my pack of exposed negatives increased in size as the unexposed diminished, while each night as I changed plates under a blanket, I asked myself wonderingly: "Am I getting what I came for?"

The last evening at Isla Verde I sat once more upon the roof of the houseboat and through my glasses watched for the last time the enchanting activity on the island. Even as I sat, I was rewarded by two never-to-be-forgotten sights.

From the west came in slow majestic flight seven of the great American egrets, which circled the island and alighted amid its green shadows. No sooner had they disappeared than, turning my glasses to the mud flat to the south, I beheld there a flock of fourteen roseate spoonbills, their gorgeous plumage in bold relief against the dark background. The finding of a roseate spoonbill is always an exciting event, and this glorious flock furnished a fitting climax to my visit.

Early the next morning we set sail again for the Point. The wind was unfavorable, and the return trip took nearly eight hours. In the bottom of the boat, wrapped in a rubber coat and protected from the sun as well as from the dancing spray, lay a package containing the photographic results of my little expedition. My mind drifted back to the time when, almost a year before to a day, we were returning from our trip to the pelicans on Bird Island, bearing a similar unknown quantity in the way of pictures, similarly protected against possible injury. Some months ago I asked you to judge *those* pictures; may I ask you now to judge *these?*

THE LOUISIANA HERON APPROACHES HER NEST CAUTIOUSLY

A portrait study of two young Louisiana herons

In this picture of a Louisiana heron the plumage is shown in all its delicate detail. Although clothed in such soft finery, these birds live in the midst of thorny and prickly growths through which they move without injury and even without apparent disarray of their feathers. This display of plumage plays an important part in the defence of the nest and in the nuptial performances. It is of interest to compare this picture with that of the egret on p. 485

Young reddish egrets in the white phase

The young reddish egret is a comical little chap

PORTRAIT OF A YOUNG EGRET JUST AFTER LEAVING THE NEST FOR THE FIRST TIME

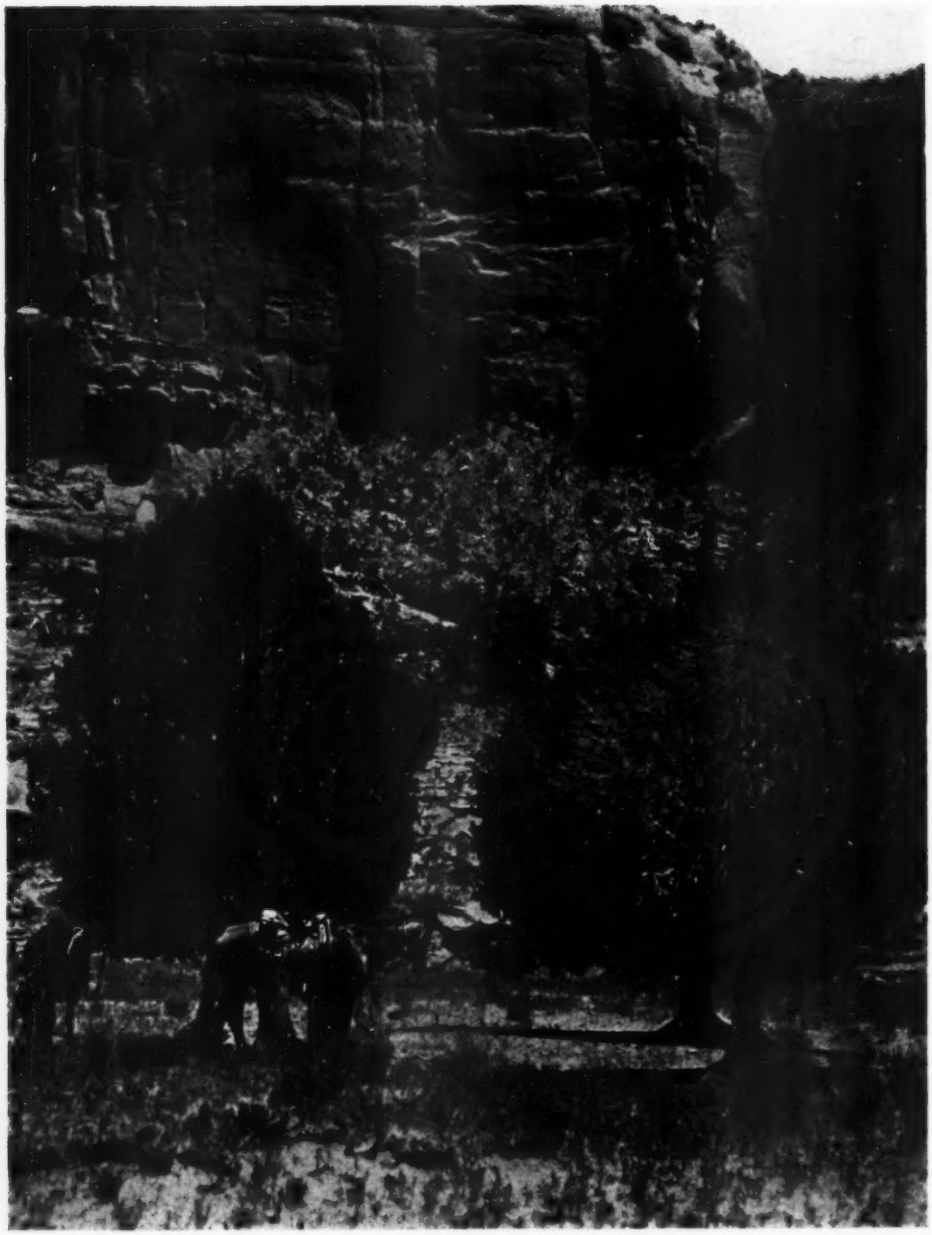
UNIV OF MICH

EGRETS HAVE A WONDERFUL SENSE OF BALANCE

Although on a very insecure perch, the bird is able to keep its equilibrium as it thrusts its head downward to examine the nest

A SHOW OF DEFIANCE

An egret, resentful of the presence of the camera near its nest, is trying to frighten away the operator by a full display ot plumage



THE WALL-LIKE ROCKS OF NAVAJO LAND

In the cañons the rocks frequently suggest walls of masonry on the face of which rectangular blocks are clearly defined as though carved by some stonecutter's tool. Occasional trees cast a bit of grateful shade, and here the horses, their girths loosened, willingly linger for an interval before the march is resumed

Navajo Land

By WILLIAM DORY

IT is a land of distance and color. In some regions the rocks and soil are themselves bright, in others the glory is chiefly atmospheric. From Carriso Mountain may be seen brown or greenish plains, and brown or greenish mesas beyond mesas, and then, finally, pale blue mountains fifty or even a hundred miles away. There to the north is the southern end of the Rockies. Other mountains stand apart from these and from one another. Between some of them the world ends in a level blue rim that seems to be the sea until a second look shows that obvious desert melts into it without a shore.

In the Navajo summer in the morning the far-distant mountains and even the far-distant plains glow with colors like those of flowers with the sun behind them or of pale stained glass. One of the colors is a beautiful blue-green, not due to vegetation.

At noon on the plains the sun usually shines with fierce glare out of the unbroken vault of intense blue down upon a yellow world. At sunset ridges may be a brilliant flame, shadows deepest purple, even though there be not a cloud. Dry as the land is, banks of cumulous clouds are not unusual in August, and very often orange sunbeams break through these and spread fanwise over the heavens.

When the sun's disk has sunk below the horizon, there comes the famed afterglow; a long, clear, pink twilight over all things. As the pink fades, the air becomes suddenly chill and man finds a blanket round his shoulders a comfort. When deep night has covered the earth, and the stranger, like the native, has rolled himself chrysalis-wise in his blanket and has lain down contented on the warm dewless sand, with the silent unfenced dark stretching away on every side, should there be no moon, he looks up at the broad overarching sky now filled with stars brilliant almost beyond belief. Then the cool clean air after the burning heat brings "sweet sleep down from the blissful skies." Such is Navajo land in summer. The winters are cold.

It is a vast desert high above the sea, with unsocial mountains standing alone, crowned with forests, and flat-topped hills (mesas), bordered by high perpendicular cliffs, and broad plains below, the whole cut by deep rock-walled cañons. Some of the cliff sides are fluted, as it were, and some, especially in the cañons, resemble walls of solid masonry, the rectangular blocks showing.

In some places may be seen piles of wind-blown sand, like the dunes of the seashore; in others a floor of rock strewn with a thin layer of sand; or, again, a floor of rock absolutely bare, its form kept broadly smooth by a myriad sand-grain chisels, driven by the wind. Of course where there is so much wind and dry sand, there are at times sand storms from which both man and beast are glad to find shelter.

The Navajo Reservation is three times as large as the state of Connecticut, but not large enough for the needs of its people,—a country where the small tufts of grass, where there is grass, are of scattered growth, and there is no water for more than a little irriga-

A glimpse into the wooded part of the mountains. In this land of little rain even a stream so feeble and trickling as the one shown has its value

tion. The San Juan River on the north flows past the country the year round, but the Little Colorado River in the south is dry for several months in much of its course. The amount of rainfall, needless to say, depends chiefly on altitude. The lofty heights are too cold for agriculture, and most of the brooks from these heights, as soon as they reach the plains, quickly lose themselves in thirsty sand. It is not that all the ground is infertile in itself, but that water is rarely found. Over most of the country rain falls so seldom that it is longed for and prayed for by the Indians as the greatest blessing the Powers above can bestow. The traveler often meets Navajos herding their sheep and goats to distant pastures or to the water holes they know.

April, May, and June are exceedingly dry, July and August are the months of most rain, and each rain is brief even then. After a summer shower flowers of great beauty appear out of what was a mere moment before nothing but parched sand, each situation producing in a surprising degree a flora of its own. Then in a little while all is dry and barren as before.

There are open woods of yellow pine on the high mountains, piñons and junipers lower, and below that the open levels. Grass grows best in the high mountains, where it has most rain, and ceases altogether at the lowest plains. Down in the cañons large separate trees now and then appear.

"A dry and thirsty land where no water is." A beautiful land. A bare, grim, and desolate land. There is a saying that no one but a Navajo could make a living from so forbidding a country; yet it is an old story that

when an Indian shows by improvement that his land is good, the white man immediately wants to take possession of it.

The Navajo Indian fought the white man long. Navajo attacks upon white settlers in their part of the world were persistent and formidable. The United States sent one military expedition after another against these Indians without permanent results. At length, in 1863, their sheep (also their carefully nurtured orchards) having been destroyed as a military measure, they were starving and a large part of the tribe surrendered. They were carried prisoners to Fort Sumner, New Mexico, where they were kept in captivity four years, during which time a few escaped and about a third of their number died. They said that if free to return to their native place, they would make war on the United States no more. At length, in 1867, they were set at liberty and allowed some sheep and goats with which to begin new flocks. They have been at peace ever since, though still hostile in sentiment to white encroachment on their domain, which now, with established limits, is a "Reservation."

The Navajos are a vigorous, industrious people, who do not share the opinion that work (other than war and hunting) is beneath a man's dignity. They have known something for generations of both dry farming and irrigating on a small scale, and individuals may be seen at present patiently leading water from whatever sources obtainable over little cornfields—if fields they can be called—patiently building and rebuilding small dams and conduits from sand and sagebrush. These efforts produce some corn, squash, and melons at the least. The Navajo plants corn with a stick, without general digging. If the soil were much lightened and stirred, the wind storms would blow it away.

Navajo faces are alert and intelligent. The people retain much of their old, proud independence of spirit notwithstanding the presence of several white superintendents within their borders. The government has broken up the old tribal systems of discipline among Indians generally, without furnishing an effective substitute in remote places. Thus the Indians sometimes get a moral discredit which, taken as a whole, they do not deserve. The government, however, appoints Indians from year to year to an office among themselves somewhat resembling our justices of the peace, and these men are said to be useful where their influence reaches.

Unlike their neighbors, the Hopi, who appear always to have been by their own rules monogamists, the Navajo native standard allows a man to have several wives although the practice seems not to have been universal. Today no direct resistance is made to the government's effort to break up polygamy, but it still exists to some extent.

Although the bride's parents are presented with horses by the bridegroom, it is denied that this is a purchase. The native marriage ceremony takes place before witnesses in a dwelling. It consists in seating bride and groom facing each other with a basket of corn meal between them. Across the basket are drawn lines to the four cardinal points, these directions being regarded as sacred, especially the east. Then, after pouring water over each other's hands, the man and woman eat a little meal from each sacred side of the basket and from the middle, beginning with the eastern

A colored headband not infrequently encircles the black glossy hair of the Navajo

across the forehead slightly confines the hair and is the only protection of the head from the sun. Though not disdaining civilized "overalls," they genally wear very loose trousers, slit to the knee and often made of cotton print. Strange to say, Dame Fashion, capricious always, decrees that the women shall leave the head bare though she allows them to carry a sun umbrella if they can procure one. A velveteen shirt is so much worn by both sexes as to be almost a distinctive tribal costume in place of the ancient buckskin or other native dress. The women pull the shirt (or more properly blouse or frock) down over a skirt which reaches to the ankles and is full

side. After this, food is served to the guests.

In common with some other Indian tribes the Navajos have the queer notion, for which they cannot themselves account, that a man must not speak to his wife's mother. A married woman will freely visit her mother, but the mother will not visit her daughter unless she knows that the son-in-law is absent.

The wife holds property entirely separate from the husband. The woman often owns flocks of sheep, and the money she gets from her weaving is her own.

Even at this late day the Navajo Indians in general appearance retain some elements of the picturesque. In figure they are straight and light. Many of the men still wear the hair long, twisted into a knot at the back. When not adopting the white man's broad soft hat, bought at a trading post on the Reservation, a folded band

When in the full glare of the intense sunlight, an Indian half-closes his eyes without screwing up the whole face as a white man does

enough to fall freely on both sides of a horse as they ride astride. The blanket is still worn by Navajos of both sexes as a cloak, but those of their own weave being heavy, are now frequently sold for rugs, while they use for cloaks lighter and cheaper ones, factory-made with gay angular designs to suit the Indian taste.

Navajo dwellings are as inconspicuous in the landscape as ant hills or the nests of birds, and seem as much a part of nature. In summer the *chahao* (shade) is much used; built of brush with the leaves on or of brush and weeds, it is open to every breeze, yet a shelter from the fierce sun. Their more substantial dwelling, the hogan, is built of logs leaning inward, carefully supported, and plastered on the outside with adobe, a natural plaster found on the ground and hardening in the sun. The smoke hole in the roof is a ventilator never shut, and the door opening is closed only with a loose blanket. For building, the logs are first laid out on the ground in a pattern prescribed by tradition according to the type of hogan required, and then raised in a prescribed order. The door is always to the east.

I shall ever remember with pleasure my first sight of the interior of a hogan at night. At the request of Mr. Hunt, a trader at Tisnaspas, a Navajo youth consented for a small consideration to conduct me to "a sing." He led me to the top of a cliff crowned with piñons and dwarf cedars, where a cool breeze blew and where a newly built hogan stood among the little trees. Near by, a number of Indians were gathered round a camp fire, some watching, others sleeping, all under the open sky, protected from the wind by a semicircular fence of cedars put together for the purpose. On the open side of this fence the firelight showed the nearest of a flock of sheep and goats. A lamb came bleating out of the darkness, was petted by the Indians, and lay down to sleep among them. Two boys, with hands painted white, came forward to greet us as we approached.

As I listened to the music floating out from the hogan, a young man said in English, "You may go in," and

Expert as blanket-weavers, the Navajos excel also as silversmiths, and necklaces made of silver are a common form of adornment

stepped over to lift the curtain. This hogan was rather larger than is usual, new and clean, its interior atmosphere still fresh even to lungs coming from the keen air outside although there were some twenty Indians within. The fragrance of the small fire of cedar in the middle of the floor was pleasant, and the firelight gave a soft glow to the brown faces of the Indians; figures, raiment, and all making a "luminist" picture in the glancing firelight against the excellent architectural background

of the slanting hogan poles. When the fire sank low, stars could be seen through the smoke hole in the roof. The Indians seemed not at all disturbed by the presence of the white man, who had been courteously bidden to enter. It was the occasion of a ceremonial singing by a medicine man,—I never found out exactly what for, receiving a scornful negative when I asked afterwards outside whether anyone were ill. Possibly it was to bless a new hogan, but it seemed more personal.

The patient, if such he was, sat with his wife at the back of the hogan. The medicine man, who led the singing, sat at the patient's right, and some ten men, three women, and three boys completed the fire-lit circle. According to custom the women took no part in the singing.

The singing was continued until dawn, with short rests between songs, a longer rest at midnight for a late supper of bread and coffee and roast ribs of mutton—of course eaten with the fingers—prepared by women on the camp fire outside. There was also a pause for prayers, which were solemnly spoken by the medicine man and repeated by the patient, clause by clause. At one time the medicine man touched the patient on various

THE EARTH-COVERED LODGE OF THE NAVAJO

This hogan, the roof of which is rather flatter than is usual in the house of the Navajo, rests, as is always the case, upon a conical framework of logs. In the construction of the hogan horizontal logs have been laid across the slanting ones to hold a flatter thatch. In the center of the roof is a hole for ventilation and for the escape of smoke. The doorway faces the east in accordance with prescribed custom, a blanket being drawn accross the opening

parts of his body and put something in his mouth.

Navajo singing rises at times to a harsh falsetto, but it is musical and has much weird charm to unaccustomed ears. The weirdness is due partly to Indian rhythms, which are more complex than ours and hard for a white man to learn,—not easy for an Indian.

The Navajos have a superstition that the original primal animals were rational beings, able to talk with humanity and still existing as spirits who may be asked for aid. Mrs. Wetherill also furnishes this less poetic conception—"Oh, big black bear, with your shoes like a knife, stand between me and danger," an

It is hard to imagine the Navajo without a horse, yet in pre-Columbian days neither this animal nor the sheep, both of which today play so important a part in the life of these Indians, were known to them

Whatever may be said of the medicine-man in other respects, it must be admitted that he is a conserver of art, music, and poetry,—and there is real poetry in Navajo prayers and songs. Take for example this prayer to the dawn, which Mrs. Wetherill has kindly allowed me to borrow:

Oh, Dawn, Dawn, beautiful Dawn, chief of the beautiful!
Let it be well before me as I go,
Let it be well behind me as I go,
Let it be well beneath me as I go,
Let it be well above me as I go,
Let all I see be well as I go.

appeal to the primal, abstract bear, a spirit. The "shoes" of an actual bear are in reality formidable weapons.

The Navajos, like various other Indians, have a ceremony of thanksgiving for the corn at the time that the green ears are ready to eat. One night, as I slept out of doors on a low mesa, I was wakened by strange music and saw a group of men dancing in the light of a half moon,—young men practising for the corn dance, I afterwards learned. Now and then one of them would separate himself from the rest

A pack train outlined against the sky, moving in rather ragged Indian file across the desert

and dance with admirable lightness and grace far out into the shadow of a higher mesa and back again,—a scout to ward off evil spirits, according to white testimony. Ere long the dancers disappeared over the rim of our mesa, the music coming faintly back to me.

At another time, in another part of the Reservation, this time in brilliant moonlight, a small number of men were dancing to a sort of chanting song, punctuated at long intervals by a drum, the men standing in one place, keeping time with their feet and swaying their bodies. As I stood up at a little distance, wearing my blanket, for the night was cool, I saw the shadow of an Indian thrown before him on the sand as he approached from behind. I refrained from turning my head; he came round in front to see who the blanketed figure might be and laughed to behold a white man in a blanket; then in a jocose manner, as if to say, "If you want to play Indian, come on," took my hand and led me among the dancers, where I tried in vain to keep time to the complex rhythm.

Kayenta, or Tyende, as the name is variously spelled, the trading post of Messrs. Wetherill and Colville, is 165 miles from a railroad, the farthest of any post office in the United States proper to receive a regular mail. It enjoys an excellent spring—an all-important matter in this dry country. The dwelling house of adobe brick and plaster is pleasantly cool within, as the southwestern adobe buildings are in summer, yet warm in winter. First seen after days of desert travel, the interior calls to mind some far-away palace of a fairy tale that a traveler through a wilderness comes to unexpectedly: the floors covered with beautiful Navajo rugs, the walls adorned with friezes from Navajo sand-painting designs, and a library of good books, and the luxury of a bathroom.

Mrs. Wetherill speaks Navajo fluently. She has made a sympathetic study of these Indians and has been ceremonially adopted into one of their clans. She has become an authority on Navajo matters.

When I first saw Kayenta, Indians

Now and then an animal would stray out of line, only to be headed off by a rider

had been encouraged to gather near it for games among themselves. Men and women on horseback, arrayed in their most festive garments for a large social occasion, unconsciously fell into pictures a painter would like to study.

One of the games, called by the unpleasant name of "the chicken pull," was played thus—A fowl, previously killed, was buried in the sand up to its neck; the Indian men, putting their horses at full speed, stooped from the saddle and tried to pull the fowl up from the ground in passing without checking their horses. Whoever succeeded in doing this won the game. The same game may be played with a leather strap instead of the fowl. After this game came a foot race for boys.

Some time later I went to Sagie, or Laguna Cañon, with a trustworthy Navajo who spoke no English, to see Betatakin and Kitsiel, the largest groups of cliff dwellings in the cañon that is still called by its Spanish name, Laguna, although there is no lake there now.

Setting out in the afternoon we rode southwestward over the plains for about four miles, stopped at a water hole, went through an opening in a fantastically indented leaning ridge of yellow rock, and west of it, entered the mouth of our red walled cañon in the great perpendicular face of a mesa. The Tyende seems a tiny stream to have carved out for itself so great a hall. The cañon has so many branches, deep and steep-sided, that they call to little human creatures to wander, lost in those vast winding halls with apparently unscalable walls, all the rest of their natural lives. Here, of old, the cliff dwellers may have played hide and seek with marauding enemies in grim earnest.

We rode on till dark; then the Indian stopped, unsaddled, fed, hobbled, and turned loose the horses, using a handful of lighted weeds as a torch so deftly that no lantern could have served better. Then he made a fire of sagebrush, pointed inquiringly to the coffee pot on the pack saddle, and finding I did not want coffee, refused any supper at all for himself. We sat a few moments by the fire before sleeping, the

A GATHERING AT KAYENTA

Games always prove an attraction and draw large groups of Indians as spectators and participants. On such occasions there are superb displays of horsemanship and the racing and other competitive feats are accompanied by not a little betting, in which the value of a blanket may be the stake

Games always prove an attraction and draw large groups of Indians as spectators and participants. On such occasions there are superb displays of horsemanship and the racing and other competitive feats are accompanied by not a little betting, in which the value of a blanket may be the stake

A COUNTENANCE OF RARE BEAUTY

This young Navajo, whose light, elastic figure is at perfect ease in the saddle, has the straight nose not uncommon among his people, large sparkling eyes, and a remarkably well-formed mouth and chin, the whole countenance lighted by an open look that is prepossessing. By way of asking him for his portrait, the author showed the camera and, for fear of losing him, held up a dollar although twenty-five cents was the usual price for a pose. The Indian gaily intimated that two dollars would be more acceptable. While pictures were being taken of him, the other men of the party, speaking in Navajo, were evidently chaffing him about his good looks and easily earned money, while his own face changed from a slight smile, soft and arch as he gave a side glance at his companions, to merry laughter at their jests

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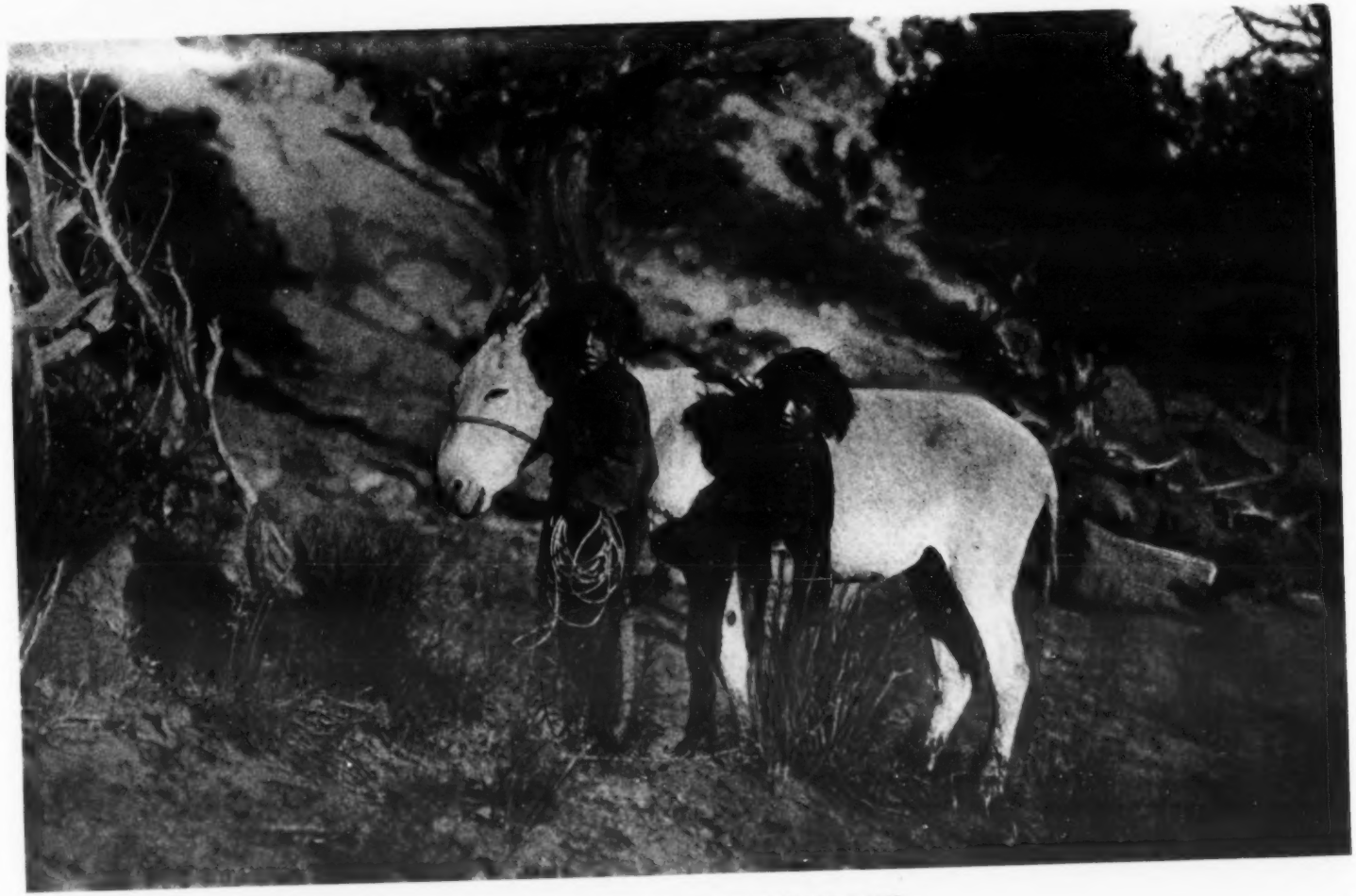
WHERE THREE IS NOT A CROWD

Navajo children get their training in horsemanship at an age when toddlers of other nations are learning how to walk



RED SKIN AND WHITE IN NAVAJO LAND

Indian rather haughty. It seemed wonderful to be there between those rocky walls with one of the only real Americans, who spoke only his own tongue. I wished I could speak his language. In the course of our trip I was able, now and then, to make a remark or ask a question, partly by signs and partly by using a Navajo vocabulary published by missionaries, and was always understood in spite of my total neglect of grammatical inflections. At first he seemed surprised when I did not fully understand his answers, but I managed to tell him that the book spoke Navajo and I did not, which seemed to amuse him, and after that he used signs more than words.

At dawn he arose and went for our animals, which had drifted out of sight down the cañon in their grazing. Returning, he "saddled up" quickly, with our sleeping blankets neatly rolled. The morning was warm and we were glad to ride on for an hour or two in the cool shadow of the rock before breakfast. The sunlight gleamed on one bit of the rim high above us and crept slowly down until it made on a gigantic scale those triangles and trapezoids of light and shade that sun-loving artists like to depict in scenes from city streets.

Toward noon we were ascending a side cañon and traversing a growth of small trees that shut in our vision. As we emerged from these, the man waved his arm with a large dramatic flourish and smiled, as though he would say: "Behold the wonder my country has to show!" There above us, in a great, evenly arched niche in the cañon wall, was Betatakin, the substantial remnant of an ancient village, under the protecting arch of solid rock,—the dwellings of a forgotten people, too high for enemies to approach below unseen, and sheltered from the possibility of attack from above.

We had dinner under the little trees that grew at the foot of the cliff, then a long rest during the heat. When it was time to go, I made signs suggesting that we spend the night at the old dwellings. I did so purposely to hear him refuse, as Navajos are said to be afraid of ghosts at night near a dwelling in which any one has died, even a cliff dweller of long ago. Among themselves they either carry the dying person out-of-doors or burn down the hogan after the burial. My guide now sternly refused in Navajo to stay and pointed to the horses. I asked "*Chindi hogan?*" (haunted house); he answered "*Okh*" (yes).

In the afternoon of the following day we halted between small patches of scrub oak, and the man indicated by laying his cheek on his hand and closing his eyes that we would sleep there. Anxious to know whether we were near Kitsiel, I looked up some words in the vocabulary and asked "House of the upright rock far?" He replied in Navajo "not far." As soon, then, as we had "made camp," which we did by merely unsaddling our beasts of burden, and he had driven them up a steep side where there was grass, we walked on to see this old, old town.

Presently the man paused in front of the cañon wall and pointed high up. He waited to let the stupid white man's eyes search the top for dwellings in vain, then touched my arm lightly and laughed, pointing lower. There, in such another niche as the one that holds Betatakin, was Kitsiel, the second largest group of crumbling buildings, another home of vanished cliff dwellers.

Next day while I was near the cliff dwellings alone, I heard from far up on the rocks above, from a place where no one could climb, a wild weird call, neither human nor animal, certainly not that of any animal I knew. I paused to listen; another and different eerie cry came from another lofty point. Some half-human creature of fable might give such a cry as that.

Presently the Indian rose out of the bushes and laughed. I suppose he had been using a whispering gallery in the rocks. Later, while I was absorbed in my work, he slipped near, unheard in his noiseless moccasined feet, and startled me by a sudden exclamation. He gently teased me for lying flat on the ground to pant after mounting the steep side of an arroyo in the heat of the day and for mislaying camera material in plain sight to his sharp eyes. These boyish pleasantries were the more striking in a middle-aged man because his face in repose was grave, even sad, if not glum, the mouth slightly curved down at the corners.

Several observers have said that the Navajo is a more ready laugher than most Indians. Is he gayer by nature, or merely more at ease in the presence of the white man because he has been less interfered with and is living his own life, beholden to no man, in his own country, wherein the white man, not the Indian, is the curiosity?

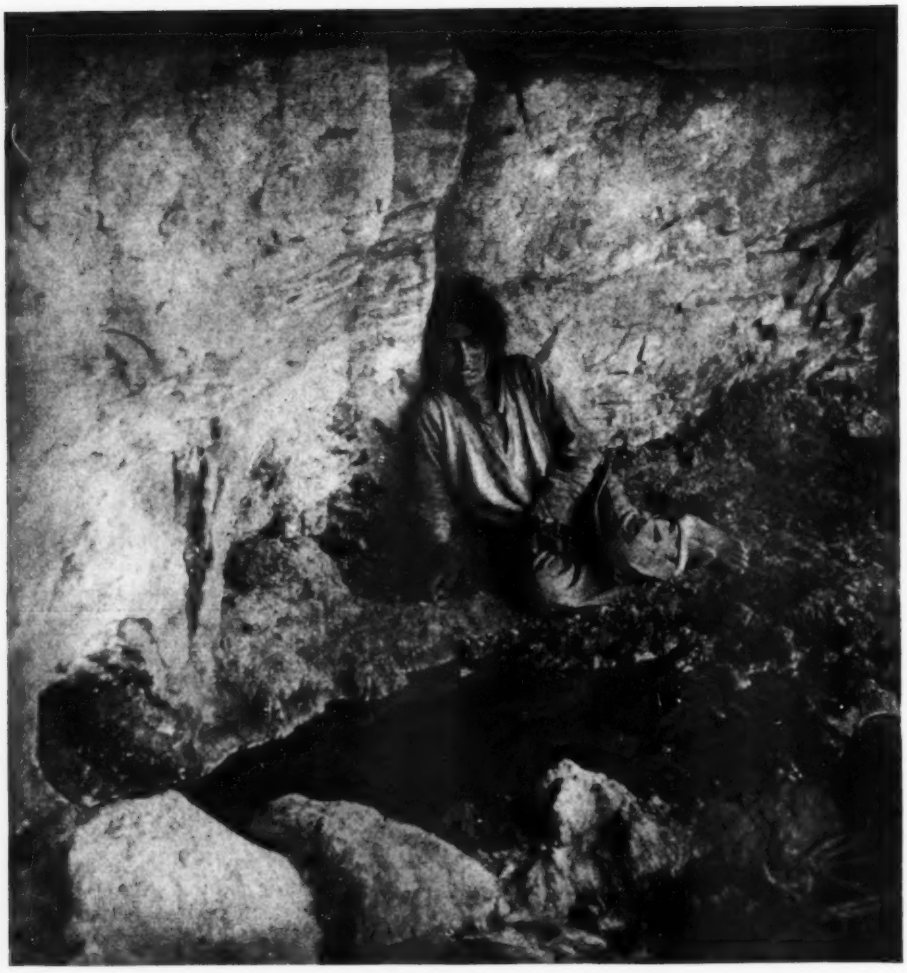
Now here in Sagie Cañon the guide and I began our return from Kitsiel in deep darkness. The sky was clouded over and there was a sprinkle of rain. It was rather thrilling to find oneself skirting the rims of black depths on horseback or suddenly plunging down into them, following someone unseen in the dark. Western ponies are wonderful for picking their way like goats and even sliding on steep rocks without falling.

In the morning, as we made our usual halt for breakfast, two pretty little boys came up, leading a white donkey, their black locks hanging wild. The man seemed very glad to see them, taking them in his arms and embracing their heads, much in the manner sometimes shown on the stage, supposedly representing a custom of ancient Rome. I tried to ask, not from the book but from careless hearsay Navajo, "Are these your sons?"—but ignorantly said, as I learned afterwards, *his* sons for *your* sons. He replied, gravely accepting my queer Navajo for my better understanding, "Yes, these are my his sons." Indian politeness as shown by this incident makes it more difficult to get the language correctly. I prepared to photograph the boys, when the man immediately held a blanket before them and asked me twenty-five cents for the privilege, which, indeed, it was well worth.

As we went onward farther down the cañon, a mounted Indian rode up carrying a shovel and spoke to the man with me, who asked permission to go with the other to bury some one. The Navajos get some person outside the family to bury their dead, if they can, and do not hesitate to ask a fellow tribesman they may meet.

I rode on, the pack mule trotting docilely on ahead. The guide rejoined me before I reached Kayenta. There we parted, with regret on my part that I should see him no more.

From Kayenta back to Tisnasbas I had a four days' journey in the open with an Indian, traveling as we did in a wagon, with a light load of hides. He was a pleasant fellow and we had an entertaining time exchanging English and Navajo names for plants and animals we passed on the way. As the season was August, we met showers



In Navajo land water is rarely found and rain is prayed for as the greatest of blessings. This stony basin, filled with refreshing water that has poured into it slowly from a little natural tunnel in the wall, is a spot where the traveler, be he Indian or white, feels tempted to linger after a long ride. The overhanging roof of rock offers shelter from the hot sun

to cool for the moment the pitiless desert heat. A long way off we could see their beautiful approach across the plain, *walls* of rain coming toward us, "standing rain" the Indians call such. The showers were brief, and wet garments in the desert air are dry again in no time.

The driver's nephew, a boy of about twelve or thirteen years, rode alongside on his pony, herding several horses before him. When rain fell heavily at night, we all three slept under the wagon. It was an opportunity for observation at close quarters. They were courteous and these two at least had not the odor of the unwashed, for they had the advantage of living near a small stream of some permanence.

By day the boy's sparkling gayety was delightful. He went off into rippling peals of fresh soft laughter at my repeated efforts to get the correct pronunciation of Navajo words. His

gayety and that of another boy I had observed on another trip was a bubbling joy that seemed different from the mirth of most lively white boys, and very different from the subdued ways of Navajo boys at school.

What is to be the future of the Navajos, this vigorous, upstanding, industrious, intelligent people? They have not been pauperized by annuities in exchange for lands; they are numerous enough to avoid consanguineous marriages, against which they have strict rules; they are nearly all of full Indian blood; moreover, they have struck out for themselves new ways to meet the changed conditions of their world, by which they support themselves beholden to no man.

The question is sometimes asked, why does the government do this or that for the Indians? Because after they were dispossessed the United States made them its wards to give them a standing although they were not citizens.

The American ideal of free education for all men did not early include red men, who were considered for many purposes as separate nations. Now all tribes in a tribal condition are given day or boarding schools as wards of the government,—in some cases directly as an act of reparation for lands taken away. The boarding school, including food, clothing, and care, is a government specialty for Indians. Besides those schools on reservations, there are several boarding schools entirely outside, to which selected Indian children are sent with the consent of their parents to their remaining for a term of years. Commonly they cannot return home from these schools in vacations because the schools are distant and the parents are too poor to pay the traveling expenses.

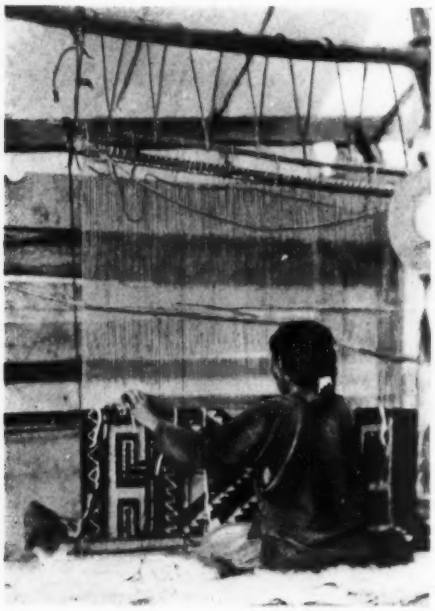
Obviously the Indian can no longer live by hunting; the white man presses him on every side; for mere self-preservation he must learn how to meet the white man's world. The calls of industry, when all impediments are removed, will doubtless draw Indians out into the general world as it has now drawn only a few. Let us hope, notwithstanding, that this race, naturally very distinct, will not everywhere obliterate itself by intermarriage, and lose all power to make further contributions of its own to our national life and thought, and all ambition for high service to its own people.

The civilized man's first idea in teaching the uncivilized has been to obliterate his racial past, the good with the bad, as all parts of one system to be forgotten. There is more willingness today than formerly to accept the good and build upon it. Why take from Indian youth in our schools that help in the battle of life that comes from respecting the best ideals of their own race? To regard a virtue as a trust from one's ancestors is one strong incentive to practice it. Now and then an Indian makes the large claim that Christian morals are such as his people taught of old. Then, too, the Indian sees the beautiful in nature. The unschooled Navajo knows his birds and quadrupeds, and calls the thousand plants of his desert by name, while many a white man goes through the world deaf to such things and blind. Many Indian songs are noble expressions of race thought, and, apart from historic interest, worth keeping for their beauty. The artistic sense shown in the crafts of the tribes, their outdoor life, their sense of social obligation, their love of ordered liberty, their dignity of manner, their reverence for the unseen are precious things, not

lightly to be thrown away, nor incompatible with the best of civilization.

We should bear in mind that what we call civilization exposes primitive peoples to new evils as well as bringing them new benefits.

What has been the red man's own thought of the white man's schools thrust upon him? We hear of an early instance on a Blackfoot Reservation,



A Navajo woman, seated on a sheepskin, weaving one of the rugs for which her people are justly famous

where the mothers rode around the boarding school building singing dirges over the loss of their children as if they were dead. More recently part of the Hopi tribe made tragic protest against the attempt to make their children over into white men. Notwithstanding such instances, red people surprisingly soon came to recognize in the school an advantage offered to their deeply loved children of learning how to "walk the white man's road." At this day, many Indians desire more schooling and better for their children, more opportunity to enter the public schools where they have the advantage of competition with white children. Some of them, again, who have themselves gone on to our secondary schools and colleges, long to see more of their number stimulated to lead and instruct their own people. A Winnebago, the Rev. Henry Roe Cloud, a graduate of Yale University, and his wife, an educated Chippewa, have a number of Indian young men under their charge at Wichita, Kansas, who are working their way toward a higher education. This is a good illustration in point. The government schools do not attempt to take pupils beyond the work of the eighth grade, with the addition of some industrial training.

Uncle Sam has provided several boarding schools on the Navajo Reservation, placed in various parts of the field, so that parents can visit their children and can take them home for the vacation, which is short. Day schools could not well be generally maintained here, because families wander about with their sheep. There are not enough schools for all the Navajo children although schools for all were promised this tribe in a treaty.

The Navajos, with whose primitive mode of life we have interfered comparatively little, have the best health of any of our Indian tribes. Tuberculosis and trachoma, those diseases that make havoc in other tribes, both acquired from the whites, are present among the Navajos but less frequent with them. At the government school at Shiprock, Navajo land, there was a short row of tents for tubercular boys, so far a return to the primitive from necessity. Trachoma is a very contagious disease of the eye, produc-

ing blindness if neglected, but curable under scientific and persevering treatment. Reservation schools among the tribes have not succeeded in exterminating it within their own walls, where because of the close contact special care is required to overcome it. Notwithstanding certain hygienic advantages, the confinement of school life seems to be more or less a strain on the vitality of primitive children, especially when combined with homesickness. The pastoral customs of the Navajos scatter them in separate families or small groups; and the hogans, though, at times of a contrary wind, oppressive with smoke, are, if not overcrowded, pretty well ventilated through the smoke hole in the roof. Important as good schooling is, health is fundamental; therefore, until schools recognize the necessity of constant fresh air, even of sleeping porch dormitories, may it not be as well that not all Navajo children are in school?

There is crying need on reservations generally for more physicians, nurses, and hospitals. Wide Navajo land has but few. Mr. and Mrs. Wetherill have built a "big hogan" as an infirmary, and also as an example of what a hogan might be, where Navajos could cook over an open fire, as usual, yet have more room to keep their belongings neatly and a chimney to prevent injury to the eyes from smoke. Mrs. Wetherill said they liked it very much.

A boast is often made of the number of Indians of other tribes who have been induced to live in houses and wear the clothing of civilization. The only house they can afford is rarely anything more than a one-room cabin with an earth floor and one small window. Having no knowledge of sanitation, the Indian keeps windows tightly shut in cold weather, while he invites all his poor relations to share his fireside. This is one cause of tuberculosis. Other causes are insufficient food, hopelessness, idleness, degeneracy from primitive vigor. The Navajos are a busy people; they are not drunkards. Their sheep supply a meat ration in place of the game now extinct.

The Navajo Reservation has been hitherto protected from the white man's greed by its desert character. When the cry comes to "open to settlement" these lands, shall we allow it to be done? Someone asks, "Exactly what is meant by 'opening' Indian lands?" "Opening" means allotting portions to individual Indians, according to the judgment of a commission appointed by the government, and selling what is left over, the so-called "surplus," to white men, the proceeds to be devoted supposedly to the benefit of the Indians. What does experience show happens then? White men rush in to get possession not only of the "surplus" but by hook or by crook of the allotments themselves, taking advantage of the business ignorance of the Indians.

In the case of the Navajos there is no shadow of reason for calling any of the land surplus, for the country, though extensive, is already overstocked by the Navajos themselves. The Navajos understand their own land system and prosper under it. Why should they not continue to hold their lands in common? Some land corporations composed of white men are doing likewise. With liberty in this matter and given a helping hand in sanitation, and protection against criminals, white or red, the Navajos will make something worth while of themselves in their own way, by their own initiative.

MARY CYNTHIA DICKERSON
1866-1923

Mary Cynthia Dickerson

1866-1923

Her Life and Personality

By MAUD SLYE

Of the Otto S. A. Sprague Memorial Institute, University of Chicago

THERE was born at Hastings, Michigan, on March 7, 1866, a little girl that was to look upon her surroundings with strange eyes. Heredity, that little-known but certain force, selecting widely among her forebears, had brought to her diverse qualities that made her almost alien in her environment. Picture to yourself this child, with a great generous heart, an alert observing mind, an intense love of beauty, and an innate craving for the exquisite, trying to find her way and puzzled in a sphere of life that seemed to have little use for any of these qualities except the generous heart.

If I were to select one phrase that would mirror Mary Cynthia Dickerson's heart and soul all her life, I would select the phrase—she tried to find her way. She spent her early life serving the constant needs of three small brothers. From a household where learning was not the tradition, she went through school, never failing in her duties there or in the home. It is easy to see that she must needs have found the beauty she craved in the sunshine, the flowers, and the small living things that she could discover in her intervals for play.

She put herself through college at a time when it was not easy for a girl to do this, teaching for a while until she could save money enough to pursue her studies, then going back to college. All through her undergraduate days that same generous heart made her give almost worshipful admiration to the intellect of others, while she was always humble regarding her own.

She attended the University of Michigan intermittently from 1886 to 1891, then taught for four years, after which she went to the University of Chicago, graduating in 1897.

After her graduation she taught in the Rhode Island State Normal School, botany, zoölogy, and nature study. Here, in the trips afield which she took with her students, she learned more and more of the minutiæ of nature, which she afterward embodied in the beautiful groups constructed by her at the American Museum of Natural History. These groups are as truly works of art as any paintings, and equally truly works of science. At the Normal School, also, she taught hundreds of students to see for the first time the marvels which only a naturalist knows.

It was during this period of teaching in Providence that she collected the data for her two works, *Moths and Butterflies* and *The Frog Book*, and for her series of articles in *Country Life in America*. It was for these books and articles that she developed her marked ability as an artistic and scientific photographer of insects, amphibians, birds, and flowers in the life. With her camera and tramping outfit she would

Details from Miss Dickerson's pictures that appear on pp. 506-09, 513 of this article have been used for purposes of illustration in "The Pageant of Nature" by Miss Dickerson, published in *Country Life in America* during 1906-07, and NATURAL HISTORY is indebted to that periodical for permission to reproduce them

A PORTRAIT OF A SCREECH OWL

go into the country for week-ends, staying at some isolated farmhouse, in order to take photographs of animals engaged in their characteristic activities among their native haunts. No photograph was ever finally accepted by her unless it was both scientific and beautiful.

From Rhode Island she went to Stanford University, where she was instructor in zoölogy for two years. She also assisted David Starr Jordan in some of his work in ichthyology, always broadening her own knowledge. From Stanford University she went to the American Museum of Natural History, where she remained until her final illness. She died in April, 1923.

The catalogued data of a human life are brief and quickly told; the living of them is slow, complex, and puzzling. According to the way in which the individual attempts to solve the perplexities of life we appraise his personality. Of Miss Dickerson it is not easy to paint a portrait that all shall recognize, for there is an urge upon the painter to portray the soul, and here was peculiarly a woman who all her life kept her soul remote from almost every contact.

If we are to paint her truly, we must visualize the ready smile, the hospitality that reached out always in greeting, the generous heart that never failed to help and to give, and the humility of spirit that underlay it all. We must paint the diligent worker, drudging through details beautiful and ugly alike, never failing in the service of work, from the simplest task to the constructing of a marvelous replica of some little fragment of nature with every minute detail true to exact fact and set in an atmosphere of loveliness. She was always willing to help in the world's drudgery, and always able to create beauty in whatever she undertook.

"I cannot see," she wrote to me during those last two years of darkness before her death, "I cannot see even the shortest distance into the future; some day when I see you, I will tell you of all my puzzlement and sorrow and despair"—a poignant reminder of the little child perplexed to find that the faculties of its heart and mind were not needed in its environment. "What shall I do without my work?" she cried. "Perhaps the doctor will let me go into some sick ward and help take care of people." And here she is again the heroic worker, who even in her own desperate illness cannot bear not to serve.

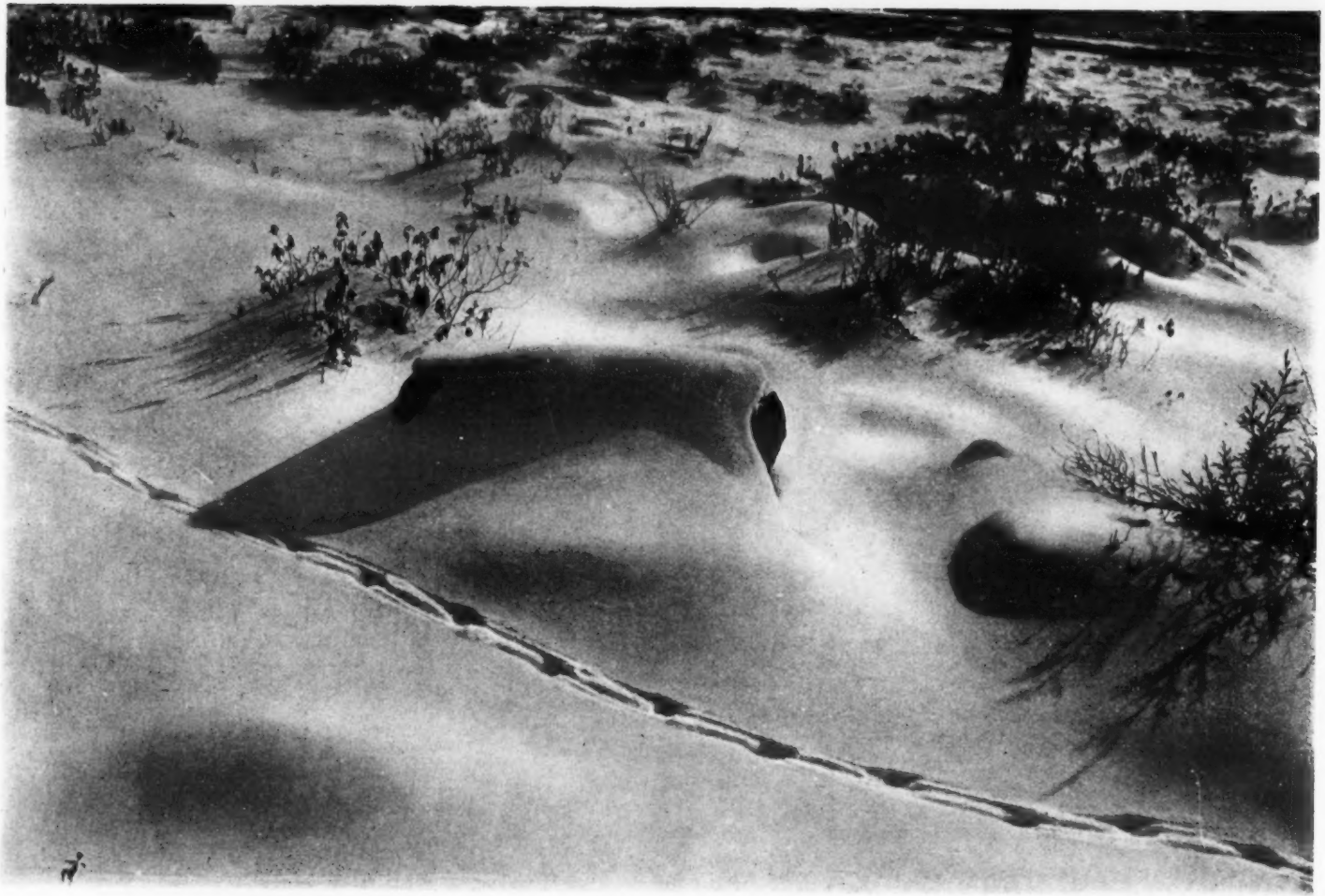
What an inspiration of selection it was that gave her Mary Cynthia for a name,—Mary, diligent, sweet, generous, ready in service, humble; Cynthia, the aspiring, the ardent seeker after the romance of the world and the romance of the cosmos! In her heart she was Mary; in her soul she was Cynthia; and always she tried to find her way.

Her Unusual Gifts as An Editor

By JOHN OLIVER LA GORCE

Associate Editor, National Geographic Magazine; Vice President, National Geographic Society

IF St. Paul had lived in our day, he would have been an ideal editor, for when, in his First Epistle to the Corinthians, he declared that he had been "made all things to all men," he laid claim to an attribute which every worthy occupant of an editorial desk most longs to possess. It is an



A CROW TRAIL IN THE SNOW

There is perhaps no more common trail to be seen the day after a storm than that of the crow. The crow's habit of dragging the feet is plainly indicated in the picture

There is perhaps no more common trail to be seen the day after a storm than that of the crow. The crow's habit of dragging the feet is plainly indicated in the picture

IN LATE APRIL FALSE HELLEBORE FAIRLY CONCEALS THE BROOK IT BORDERS

AN UNDERWATER PHOTOGRAPH OF THE LOBSTER

The lobster crawls over the sea bottom, hidden by his resemblance to seaweeds and rocks. In combat he is no match for the blue crab. Photographed from a specimen five inches long

AN UNDERWATER PHOTOGRAPH OF THE LOBSTER

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SEA ANEMONES

Like flowers, these beautiful sea anemones hang among the swaying seaweeds. At night they stretch out to three or four times their usual length

UNIV. OF MICH.

editor's chief end to acquire the power, to cultivate the gift not only of seeing each thing and each subject from the author's point of view but in the perspective of a host of readers of diverse interests and varying intellectual backgrounds.

Mary Cynthia Dickerson possessed this gift to a unique degree. There are authors in many parts of America and Europe who will bear testimony to the fact, for few indeed are the manuscripts which passed before her judicial eye and understanding heart that did not profit by her kindly and constructive criticism and her expert sense of their appeal to the reading public.

The successful editor is he whose information is sufficiently broad and whose tastes are sufficiently catholic to discriminate between the spurious and the true. He plays alone the rôle of a Supreme Court of Criticism from which there is no appeal. That which is excised at his hands in most instances is lost to the world of letters forever. It is a weighty responsibility to signal with blue pencil "thumbs-down" to a thought! How potent is this sentence, how revealing this expression, how vital this group of facts? Has the author, familiar with his subject through deep study and close contact, expressed himself in such a way as to convey the right idea most effectually to the less well-informed reader? These are ever-recurring questions, and the editor who knows the answer is playing a stellar rôle, though to all outward intents an anonymous one in the magazine world.

Had Miss Dickerson devoted her rare talents of observation, analysis, and description exclusively to authorship, her name would occupy a more conspicuous place on the book shelves devoted to natural history, but she chose to live the part of Martha in the household of letters, performing the unspectacular but essential tasks of selection, supervision, and revision. As a result of that unselfish choice, her fame may fade but her influence will continue to radiate in many directions, and every future reader of NATURAL HISTORY as well as every contributor to its pages during her editorship will profit by her wise judgment, her wide vision, and her broad scholarship. It is to be hoped that her splendid achievements and her ideals as to the place which NATURAL HISTORY should occupy in the fields of science and of letters will prove an inspiration and a beacon to those who assume those responsibilities from which death alone has relieved her.

A great editor is a mental receiving and transmitting station, connecting the author with his myriad-minded public. Mary Cynthia Dickerson nobly performed this exalted function for NATURAL HISTORY.

Her Studies of Reptiles and Amphibians

BY G. KINGSLEY NOBLE
Associate Curator [in charge] of Herpetology, American Museum

A GREAT painting is more than an expression of harmony, balance, and sequence in line and color. It is a reflection of a great personality. Mary Cynthia Dickerson produced during her association with the American Museum a series of masterpieces of the highest rank. Her reptile and amphibian groups, so greatly admired by everyone, epitomize her long years of field study and her understanding of art. In each of the

groups she has, to use her own words, "attempted to suggest the spirit" of the scene. The Bull Frog Group and the Tree Toad Group reflect the spirit of the marshland, a spirit that Miss Dickerson knew and loved.

It may be said that Miss Dickerson had a real affection for each creature she studied. No living material other than that which could be properly cared for was ever permitted in her laboratories. She was a keen observer, an admirable student of the habits of all living things. She engaged in research of importance on fishes, Crustacea, and Lepidoptera, as well as on reptiles and amphibians. Miss Dickerson's greatest interest was always in her scientific work and especially in building up a department of herpetology in the American Museum. And yet the artistic side of every phase of this work appealed to her strongly. In reporting upon the facies of the Florida Cypress Swamp, where she made studies for her last and greatest group, she writes:

"No pictures and no reading can carry the effect . . . to the mind. It might be on another planet, so different is it from anything else on this globe. In visiting the Sequoia forests of the Pacific Coast, we are filled with wonder at the magnitude of the trees; at the sight of certain cactus growths on mountain slopes in the Southwest we may receive a thrill as though entering some dimly remembered garden of ancient gods; but nothing has prepared us for the influence of the Florida cypress swamp in the full sunshine of the afternoon."

Miss Dickerson carried on most of her field work alone. She was always an independent and highly original thinker. To take but a single illustration of her originality,—one day when mounting one of the water newts in the

A bull frog at rest in an aquarium.—Miss Dickerson supplemented her extensive field observations by careful studies in the laboratory

act of shedding its skin, her assistants found it extremely difficult to imitate the shed skin in wax, celluloid, or any other medium. When the matter was referred to Miss Dickerson, she suggested at once exactly the right thing—an onion skin.

Long before Miss Dickerson came to the Museum, she had made an enviable reputation for herself by producing one of the most outstanding contributions to North American natural history—*The Frog Book*. It is to this book that every naturalist must turn sooner or later to be thrilled by the charm of her expression, the beauty of her illustrations, and above all by the spirit of nature which she has transplanted into this great work.

Miss Dickerson perhaps displayed her greatest genius in her work in the Museum, especially in organizing the department of herpetology, of which she was made curator in 1919. From the beginning she realized that a department without a collection was not worthy of the name. Hence, she made every effort to bring material together. It was through her zeal that expeditions were sent to Porto Rico, Santo Domingo, Nicaragua, Mexico, and Florida, primarily to secure reptiles and amphibians. She corresponded with many foreign collectors in China, India, New Zealand, Africa, South America, and elsewhere, in an effort to enlarge the collections. As a result, in ten years the American Museum collection has increased from one of the smallest to the fourth largest museum collection in the United States, and now includes nearly 50,000 specimens.

Miss Dickerson early interested herself in the technical work of the department. She began a series of investigations of West Indian herpetology and published a description of a new amphisbænian from the Isle of Pines. For several years she studied collections of reptiles from Lower California and the Southwest, especially the collection made by the Albatross Expedition of 1911. In a preliminary paper entitled "Diagnoses of Twenty-Three New Species and a New Genus of Lizards from Lower California" she gave a brief summary of her finds, hoping to publish later an exhaustive treatise on the reptiles of the Southwest. Her health never permitted her to finish this second paper.

Miss Dickerson in all her endeavors was highly idealistic. It is gratifying to know that the ideals for which she worked are gradually being realized. A hall to be used exclusively for reptiles and amphibians is now under construction as part of the new southeast wing of the American Museum. Here will be installed her groups. It is hoped that this hall will reflect something of Miss Dickerson's personality, her love of nature, and her deep understanding of some of its smaller creatures.

Her Achievement in Popularizing the Knowledge of Trees and Forestry

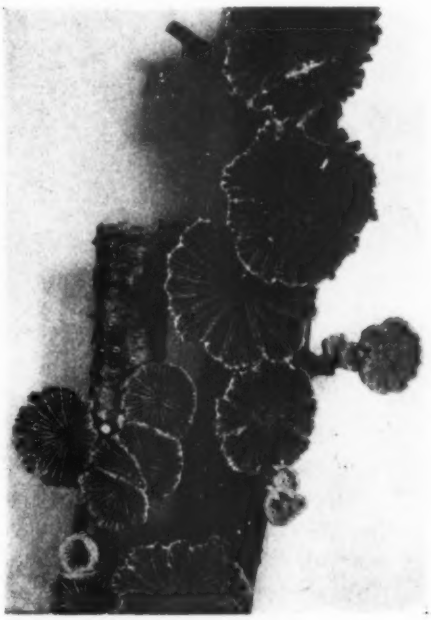
By BARRINGTON MOORE
Editor-in-Chief of *Ecology*

MISS Dickerson's foresight, imagination, and love of beauty, as well as her scientific spirit and indomitable energy, stood out strongly in her work as curator of woods and forestry. She fully realized the great opportunities offered by this branch of the American Museum's

activities, and planned to create at the Museum a center of popular education and of research in forests and trees. No such center exists in this country, nor, so far as we know, in any other land. There are forest schools in a number of universities for the training of professional foresters, just as there are schools of engineering, law, and medicine. There are a few ranger schools that give the grounding in forestry required by forest rangers, woodsmen, and others who do not need the higher technical training of the college. The forest departments of the Federal Government and of the states, in addition to their other manifold duties, disseminate information and answer inquiries; the forestry associations reach those already interested. But there is no popular, easily accessible source of free information which comes in touch with the man in the street and shows him clearly and simply what the forests mean in his daily life, and what forestry is doing to protect and grow the thousand and one tree products on which our civilization depends.

Miss Dickerson understood the importance of an awakened and accurately informed public interest in our forests, and foresaw the profound influence which the American Museum could exert in this direction through its contact with the vast population of New York. She realized also that the influence would extend far beyond the city itself, because almost everyone in the country visits New York sooner or later. The great benefit to the public which would flow from a forestry center in New York appealed strongly to her imagination.

The importance of popularizing forestry did not blind Miss Dickerson to the value of research. She understood that research is the foundation of education, and the source from which the materials for instruction are derived. She hoped to make the department of woods and forestry a Mecca which leading foresters from all over the world would feel impelled to visit, when sojourning in America, just as students of evolution now come to the Museum's department of palæontology.



Fungus wheels with their spring plumpness and symmetry

As part of her plan of popular education in forestry Miss Dickerson wrote an excellent pamphlet on the subject. Her knowledge of trees and plants was of a high order, and this little book is one of the best popular works on forestry that has ever been prepared. It had been out of print for a considerable length of time, but instead of merely having it reprinted she wished to revise it and bring it up to date. For this purpose she had collected at

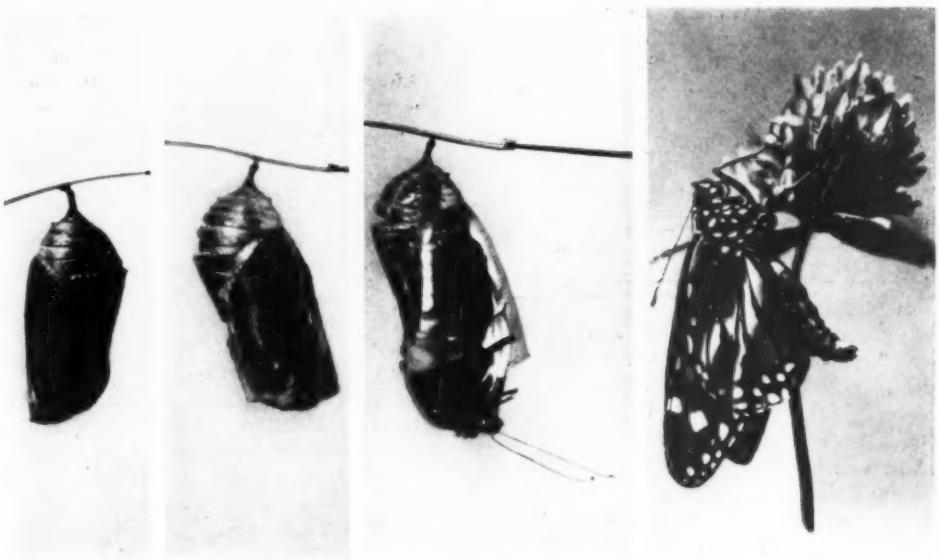
The flowers of the tulip tree, *Liriodendron tulipifera*

the time of her death a considerable amount of material.

Her efforts in exhibitions for the department of woods and forestry were concentrated on the Jesup collection of American woods. This collection, brought together by Charles S. Sargent through the generosity of Morris K. Jesup, is unique. It was made just before our magnificent virgin forests had given way to the ax and the flames. The forests from which many of the specimens were taken have been ruthlessly destroyed, and with them the possibility of ever again making a similar collection. The sections are taken from the finest trees, and represent the growth of many centuries. She intended to place on each tree a label which would be not only scientifically accurate but interesting, and would give some indication of the conditions under which the tree grew in nature. Owing to the limited space, this required a high degree of skill in writing as well as complete information. The plan was carried out for most but not all of the trees in the collection. She devised the special type of labels on green paper with wooden backing which, while affording the information, blend naturally with the tree trunks. The green setting for the colored pictures of blossoms and leaves placed above the trunks was likewise selected with care and good taste. Her keen love of the beautiful found expression, so far as the Jesup collection is concerned, through the remarkable sprays of leaves, flowers, and fruits which, through her efforts, were represented in wax and other materials and attached to a number of the tree trunks. The large magnolia

blossom, which is the most conspicuous example of this work, gave her genuine pleasure.

Although representative of her activities in herpetology, her well-known Florida group should be considered also in connection with her accomplishments in forestry. In arranging the environment of the Florida animals, she recreated within the Museum an excellent example of a cypress forest. With consummate skill she reproduced the details, even to the under-story of shrubs and herbs, faithfully and accurately, while at the same time creating a truly beautiful effect. In this group she shows her guiding principle, that science must go hand in hand with beauty in order to reach and benefit mankind.



The emergence of the monarch butterfly is illustrated in this sequence. On the extreme left is the chrysalis with the butterfly showing through. In the adjoining picture the first split in the chrysalis is seen. The photograph next in order is of the butterfly crawling forth; the transparency of the chrysalis is well indicated in this picture. On the extreme right is the butterfly a few seconds after emergence. From *Moths and Butterflies* by Mary C. Dickerson; reproduced by courtesy of Ginn and Company

NOTES

FOSSIL VERTEBRATES

EVOLUTION OF THE PROBOSCIDEA.—For the better part of the last twenty-three years Prof. Henry Fairfield Osborn has been especially studying the evolution of four different kinds of fossil mammals, namely: (1) the rhinoceroses, regarding which he has published twelve papers up to the present time, including the description of *Baluchitherium* in the issue of NATURAL HISTORY for May–June, 1923; (2) the horses, work on which was begun in 1904 and has resulted in fifteen papers, concluding with the Memoir on the types of horses in Oligocene, Miocene, and Pliocene times of North America; (3) the titanotheres, discussed in twelve papers, the last to come from Professor Osborn's pen being the monograph entitled, *The Titanotheres of Ancient Wyoming, Dakota, and Nebraska*, now in press as *Monograph No. 55* of the United States Geological Survey; (4) the elephants and mastodons, work on which was begun in 1900. The last-mentioned group is represented by twenty-seven papers, including a large *Memoir* entitled, *The Evolution of the Proboscidea*.

The *Memoir* on the Proboscidea ranks next to that on the titanotheres as a most exhaustive piece of research, to which Professor Osborn has given a full measure of devotion and effort; it will present the type description of every kind of proboscidean that has been recorded, the fauna embracing all parts of the world except Australia. Since the Swedish naturalist, Carl Linnæus, named the Indian elephant *Elephas indicus* in 1758, more than a century and a half has elapsed in which no less than 53 genera and 276 species have been named from Europe, Asia, Africa, North America, and South America, as well as from the islands of the Mediterranean, from the East Indies, and from Japan. The *Memoir* will contain a wealth of illustrations, including facsimile reproductions of all the type figures of Proboscidea which have been published and a superb series of pen-line illustrations by Mrs. L. M. Sterling, whose first drawings of proboscideans were made twenty-one years ago. Curator R. W. Tower is arranging for the reception of this great piece of typographic and illustrative work by the American Museum press. It will form the first *Memoir* of a new series, in which each *Memoir* will constitute a volume by itself.

THE ELEPHANTS OF SOUTHWESTERN EUROPE.—In Upper Pliocene times, that is, just before the beginning of the Ice Age, a great international congress of elephants assembled in southwestern Europe, in northern Italy, and in southern France. It is probably a mark of the sagacity of these animals that they came from different continents to enjoy the most delightful climate in the world at the close of Pliocene time. Professor Henry Fairfield Osborn had already reached this opinion in the course of preparing the *Memoir*, referred to in the previous note, but it has been more than confirmed in the two small but invaluable contributions just received from the laboratories of Professor Depéret, entitled: "*Elephas planifrons* Falconer" and "Monographie des Éléphants Pliocènes de l'Europe et de l'Afrique du Nord." It is shown in these studies that to this region there migrated two kinds of elephants from the Siwaliks of India, a third kind from northern Asia, a fourth, thus far discovered only in western Europe, and a fifth that turned northward from Africa. North America alone was not represented at this congress of proboscidean sages, because at no time was it the homeland or center of migration or dispersal.

Like Professor Osborn, Professor Depéret is an ardent polyphyletist; he believes in many separate lines of descent dating back to very remote times in the Age of Mammals. It is probable that the combined interest of these two writers will give the death blow to old monophyletic theories, such as that which traces the elephant from the *Stegodon*, and the *Stegodon* from the *Mastodon*. Under date of June 7, 1923, Professor Depéret wrote to Professor Osborn feelingly on this point:

Je vous remercie également des éloges précieux que vous voulez bien faire au sujet de mon étude sur les Éléphants pliocènes. J'ai eu la très grande satisfaction de me trouver d'accord avec vous sur la plupart des questions phylogéniques, notamment sur le parallelisme des rameaux des Éléphants et sur la question de leur origine. Il fallait à tout prix *couper le cou* à cette vieille erreur de la transformation des Mastodontes en Éléphants, par l'intermédiaire des *Stegodon*. Grâce á notre entente commune, je pense que la vérité pénétrera plus facilement dans le monde des paléontologistes. La publication de mon étude sur les Éléphants a soulevé en France déja un gros émoi et m'a valu de la plupart de mes confrères des Universités des éloges peut-être exagérés. Mais aucun ne m'a été plus précieux que votre approbation.

BURMESE FOSSILS COLLECTED BY MR. BARNUM BROWN.—The remarkable collection of fossils made by Mr. Barnum Brown in the Siwalik Hills of India through the aid of the Mrs. Henry C. Frick Fund has arrived safely in the American Museum. On completing his highly successful work in this part of India, Mr. Brown traveled eastward to Burma and explored the Upper Eocene beds described some years ago by Guy C. Pilgrim for the Geological Survey of India. These beds are of exceptional interest to the American Museum because they contain fossils closely similar to those found in 1922 by the Third Asiatic Expedition in southeast Mongolia and long previously in the Uinta Mountains of Utah.

Under date of April 28 Mr. Brown wrote from Sagaing of his Burmese trip:

At last I am through with the long bullock-cart trip, which lasted nearly two months and covered 150 miles of teak-bamboo jungle over trails that are indescribable.

Through lack of roads I was forced to abandon all thought of collecting in the Irrawaddy series westward, and confined my attention exclusively to the Eocene Pondaung purple clays, the only member that contains vertebrate fossils.

The collection is small, but better than all combined collections made heretofore, and I believe contains all described species. The choice specimens are a complete skull and lower jaws of a small anthracothere [an animal related to the pigs]; lower jaws of *Metamynodon* [a rhinoceros]; upper and lower dentition of *Anthracohyus* from the Eocene, and half of a lower jaw of *Stegodon*, with a good tooth from the Irrawaddy series. This is a curious fauna in which carnivores, insectivores, and rodents are absent.

The conditions of occurrence in the Eocene beds are unique. Vertebrate fossils are confined to highly colored clays at the top of the Pondaung series, and were never found in the sandstones above or below. I have some doubts whether they are a part of the Pondaung Age. These clays are about fifty feet thick, predominantly a brilliant purple; ochrous yellow and white clays form contact with sandstones above and below, and the central fossiliferous part is reddish purple.

Near Myaing the purple clays appear first where the entire pre-Irrawaddy series are on edge, thence northwestward they appear and disappear at intervals in patches a few yards in length according to the amount of folding and displacement that has taken place. A few miles beyond Myaing the underbrush increases to forest and dense jungle, through which it was exceedingly difficult to follow a course. I would frequently ride and walk ten hours without seeing a fossil, for they occur in localized areas with barren places between.

Contrary to published data, I found mammal remains nearly as numerous as those of reptiles and sufficiently associated to spur one on with the hope of securing good material at the next exposure, but following this purple streak was like chasing a rainbow.

Somewhere in Burma favorable exposures of this purple Eocene bed will develop good material, probably on the westward slope of the Pondaung uplift or northeastward crossing into China, but it will be a long time before these areas are accessible.

Subsequently Mr. Brown proceeded up the Irrawaddy River to examine formations of the more recent Miocene Age. Thence his plans were to go westward and examine the early Pliocene quarries on the Island of Samos, with the expectation of returning to the Museum toward the end of the year.

THE PALÆONTOLOGY OF CHINA.—Dr. A. W. Grabau, formerly professor of palæontology in Columbia University, author of one of the most valuable treatises on stratigraphic palæontology, and now connected with the Geological Survey of China, is engaged in the publication of the *Palæontologia Sinica*, embracing both the invertebrate and the vertebrate palæontology of China. He writes from Peking, April 18, 1923:

The *Palæontologia Sinica* is our pet child and we hope to make a big success of it. The publication is assured for a long time and we have a very good artist to make the illustrations. It is indeed a great pleasure to cooperate with your party and I have had many interesting evenings with Doctor Morris discussing the details of the campaign for the Palæozoic rocks in the Mongolian Geosyncline. The problem is an extremely interesting one and the Third Asiatic Expedition can make a most far-reaching contribution to the geology of Asia by such detailed work on these old rocks. You will be interested in the series of the palæogeographic maps of Asia which we are preparing and which will soon be published by the Survey. They take in every phase of the Palæozoic and give a good picture of the changes in the conditions as they affected Asia in the past. We hope also to have a small number of palæogeographic maps of the Mesozoic and the Cenozoic.

Doctor Grabau is engaged on the description of all the collections of invertebrate fossils brought back to Peking by the Third Asiatic Expedition. Dr. Charles P. Berkey, under date of June 9, 1923, pays a high tribute to Doctor Grabau's work in this field:

I do not know of anyone in the world who is more versatile and ingenious or more suggestive in the field of stratigraphy than Doctor Grabau. He ought to have opportunity, after finishing his work in China, to undertake a revision of the stratigraphy of the world. That ought to be his major life

work and to do it he ought to be supported in American institutions. I devoutly hope that the American Museum of Natural History, together with the research interests of Columbia University, perhaps by securing some special endowment or funds, may be able to establish him in that work on a basis that would insure a valuable scientific contribution of interest to every geologist in the world and to every country.

THE ANNUAL MEETING OF THE PALÆONTOLOGISCHE GESELLSCHAFT for the year 1923 was held in Vienna under the presidency of Professor Othenio Abel and the secretaryship of O. Antonius. The meeting opened in the great hall of the University on Monday, September 24, with an address by Professor J. F. Pompeckj entitled "Die Anfänge des Lebens." Tuesday and Wednesday were devoted respectively to a visit to the palace of Schönbrunn and to a geological excursion. On Thursday evening President Abel delivered his address, "Lebensbild der eiszeitlichen Tierwelt der Drachenhöhle bei Mixnitz in Steiermark." Friday was set apart for excursions to the Kahlenberg and to Klosterneuburg. On Saturday the society visited the Drachenhöhle in Rötelstein and, under the guidance of Mr. Adolf Mayer, the celebrated Lurgrotte. Other excursions were arranged to the Tertiary of the Vienna basin and to the Sonnwendstein, under the guidance respectively of F. X. Schaffer and L. Kober.

FOSSIL MAMMALS OF THE FAYÛM.—In 1920-21 Dr. Hikoshichirô Matsumoto, professor in the Tôhoku Imperial University of Sendai, Japan, visited this country and spent several months in studying the palæontological collections of this museum. He undertook as a special research the revision and description of the fossil proboscideans and hyracoids in the collection obtained in the Fayûm district of Egypt in 1907 by the expedition in charge of Professor Henry Fairfield Osborn. This is one of five important collections made from the Fayûm, the others being in London, Cairo, Stuttgart, and Munich; but it has been only in small part described. The two most important groups among its fossil mammals were entrusted to Doctor Matsumoto for such description, and the result of his very thorough and able study of the material is now, after a considerable delay due to direct and indirect effects of war conditions, in course of publication in the American Museum *Bulletin*. It will appear in three articles, the first dealing with *Mœritherium*, the second with *Palæomastodon*, and the third with the hyracoid genera. Preliminary abstracts of his results have been published in the American Museum *Novitates*, No. 51, and in the *Proceedings* of the Zoölogical Society of London, December, 1921.

He discusses at length the difficult problem of the true relations of *Mœritherium* to the ancestry of the proboscideans. The genus has been considered, on the one hand, as a direct or nearly direct ancestor of *Palæomastodon* and the later mastodons and elephants; on the other, as not in the proboscidean order at all but more nearly related to the sirenians. Matsumoto takes an intermediate position, regarding the animal as a primitive member of the Proboscidea but not close to the ancestral line of the mastodons and elephants. In his review of *Palæomastodon* he shows that the genus is a composite of two already distinct lines or phyla: one of these, to which the genus name is restricted, has a somewhat shortened jaw and other characters that indicate it as an early ancestor of the true mastodon of North America; the other, to which the name *Phiomia* has been applied, has a very long jaw and other characters appropriate to an ancestor of the long-jawed mastodons, which inhabited all of the northern continents during the later Tertiary Period.

Matsumoto's third paper deals with the Hyracoidea, an order of mammals now nearly extinct, the little hyraxes or coneys of Syria and north and east Africa being the only survivors. In the Fayûm deposits are found remains of a great number and variety of animals allied to the coney, some as large as a pig or even a cow. From this and other evidence it is believed that they were once an important order of herbivorous animals which in Tertiary Africa took the place in part of the modern types of herbivora that had not then reached that continent.—D. W. M.

THE CENTENARY OF JOSEPH LEIDY

The year 1923 is the centenary of the birth of one of the most distinguished scientists America has produced—Joseph Leidy of Philadelphia. The occasion will be celebrated not on Joseph Leidy's birthday, September 9, which falls within a season of the year when formal gatherings are few, but on December 8 by the Academy of Natural Sciences of Philadelphia, with which venerable and honorable institution Joseph Leidy was most closely associated throughout his great career.

Leidy's life work cannot be characterized in a single sentence; it was wonderfully thorough and broad. He was master of several sciences —anatomy, microscopy, helminthology, palæontology. He was a draughtsman of unusual skill and a writer who had a most scrupulous regard for truthful and accurate description. In contrast to his younger contemporary, Edward Drinker Cope, Joseph Leidy belonged rather to the *École des Faits* of Cuvier than to any school of speculation. It would be difficult to single out the greatest of his several masterpieces, but the volume which will probably endure longest is the great palæontological memoir of 1869, which is bound to remain a classic because of its accuracy of description, beauty of illustration, and breadth of erudition. Leidy was honored and beloved; he had many friends and no scientific enemies. He lived quietly, unostentatiously, and leaves in our minds the impression of a great personality.

WILLIAM A. HAINES

In the July-August issue of NATURAL HISTORY (p. 423) reference was made to the gift of a portrait of William A. Haines whose distinguished rôle in the early history of the American Museum is fittingly recalled in this connection. He was one of those principally concerned in promoting the Museum idea and in making it an actuality. He was a member of a Special Committee of three that was appointed to perfect the organization of the proposed Museum and that nominated the first Board of Trustees. A memorable meeting of this Board took place at the residence of Mr. Haines, in which a plan for subscriptions was formulated and steps taken that resulted in the establishment of the American Museum on an assured footing. Mr. Haines' preëminent ability as an organizer received recognition in his appointment with Messrs. Joseph H. Choate and Howard Potter to the committee that prepared a charter for the new institution, suggested a name for it, and applied to the Legislature for the passage of an act of incorporation. On April 6, 1869, the application was acted upon favorably by both houses of the Legislature, and the American Museum took its place among the institutions of the city and the nation.

In addition to being one of the twenty-one Founders, or original Board, of the Museum, Mr. Haines had the distinction of being the first Chairman of the Executive Committee. His activities were not relaxed even after the establishment of the Museum had been assured, thanks to his invaluable coöperation. Throughout the crucial years of its early history his loyal support was no small factor in promoting the welfare of the institution. When a change of site from the Arsenal in Central Park, where the Museum was first housed, became imperative, Mr. Haines was one of three charged with the responsibility of selecting the spot that should be its permanent home, and subsequently he served as a member of a committee of four that took under consideration the architectural plans that were submitted for the Museum. In 1880, at the premature age of fifty-eight, Mr. Haines was summoned irrevocably from a world that he had enriched by his personality and his labors. Yet before death came, he had had the satisfaction of seeing the institution which he and other public-spirited men had visioned, well started on its career of public service, for six years previously the cornerstone of the first section of the present Museum edifice had been laid by President Grant in the presence of an audience that included three members of the President's

WILLIAM A. HAINES.—To his remarkable ability as an organizer and his untiring devotion the American Museum is not a little indebted for its start in life. From a painting recently presented to the Museum by Miss Emily Somers Haines in fulfillment of a bequest by her brother

official family, the Governor of the State of New York, the Mayor of the city, and many other distinguished citizens.

THE FAUNTHORPE-VERNAY INDIAN EXPEDITION OF 1923

Colonel J. C. Faunthorpe has suggested that the name of Mr. Arthur Vernay, who has contributed in so many important ways to the success of the expedition in which he has been participating, be coupled with his own in all future references thereto, and President Henry Fairfield Osborn has approved of changing the name of the undertaking from the Faunthorpe Indian Expedition of 1923 to the Faunthorpe-Vernay Indian Expedition of 1923.

Too much stress cannot be laid on the importance of the results achieved by this expedition, thanks to the enterprise and devotion of its leaders. The specimens obtained assure the perpetuation as museum groups of a number of the distinctive animals of India that are on the road to extinction. That the expedition was undertaken only barely in time is evidenced by the exceeding rarity of some of the animals sought, witness, for instance, the pink-headed.

SEARCH FOR PINK-HEADED DUCK.—Colonel Faunthorpe writes from Lucknow, May 25, 1923, that he has thus far been unable to secure specimens of the pink-headed duck.

I regret to say that we have entirely failed to obtain or even hear of a specimen of the pink-headed duck. I had some hopes of obtaining one on the Nepal border north of Oudh as one specimen was undoubtedly shot there two years ago. I quote a letter from a man now resident in the Kheri District on the subject. It was his brother, now in England, who shot it.

"I have heard from Jack about the pink-headed duck. He says he shot a pink-headed duck in the Nimbwa Bojh Swamp, that broad patch of water between the two *bojhis*. He found it with a number of teal and thought it was a red-headed pochard except for the head. It was flying backwards and forwards and at last he shot it. If it had not been for his dog, he would not have recovered it as it fell into thick *narkul*. He took it to camp and showed it to de Carteret, who informed him what it was. He skinned it and de Carteret sent it to the Bombay Natural History Society. It is the only one de Carteret has ever seen."

I spent four and a half years in this district and never heard of the bird during that time. There is, however, no doubt that one specimen was shot last year in the Shahjahanpur District, which adjoins Kheri District on the west, and another specimen two years ago in Kheri District itself. Hence, although enquiries tend to show that it is extinct in Behar and Orisa, where in old days it occurred most frequently, it is possible that there may be here and there a pair nesting in some inaccessible swamp in or near the Nepal Terai. It is interesting to observe that the specimens shot in Kheri and Shahjahanpur were flying in company with a lot of teal.

THE VANISHING LION OF INDIA.—The lion, which was formerly abundant in India, is now approaching the vanishing point and very wisely the Indian government is not granting permission to shoot specimens except in very special cases. It is the hope that through the good offices of the Indian government such permission may be given to Colonel Faunthorpe next season and that the American Museum may thus come into the possession of a specimen of this rare animal. Of the Indian lion Colonel Faunthorpe writes:

The Gir forest in Kathiawar, Bombay Presidency, is the only place where the Indian lion now survives. In olden days they were not uncommon in central India and as far north as Delhi, and it is on record that one was shot in Allahabad District, or near there as late as 1865. The disappearance of the lion may, I think, be ascribed to two causes—(1), it lived in a comparatively open country and was easily located and shot, and (2) when tigers became abundant, they drove out the lions. In certain parts of the country where heavy jungles still exist, the tiger is in no danger of extinction at present. For instance, in the Kheri District, from which we have just returned, there are certainly more tigers than there were ten years ago.

In another connection Colonel Faunthorpe writes:

Some African lions were introduced into India ten or more years ago. One of the native princes bought some of these lions and turned them loose. It was the intention to feed donkeys to them, but the lions took to eating villagers exclusively. Accordingly efforts were made to destroy the lions and I believe they were all shot.

These African lions are not to be confused with the Indian lion of the Gir forest.

THE MAMMALS OF BURMA.—The final journey of the present season for Colonel Faunthorpe and Mr. Vernay was into Burmah. In a letter dated from Lucknow, June 6, Colonel Faunthorpe tells of their experiences:

Up to the time I left Burma we had secured material for a good group of thamin, or brow-antlered deer, namely one large stag, one small stag, two does, and one fawn. This will make a very beautiful group. We had up to the time I left secured only one bull tsine, and Vernay stayed on in order to get another bull and a cow, which I expect he has done by this time. The pursuit of the tsine involves hard work as he is a very active and wary

animal and, when disturbed, travels for great distances. All the tracking was on foot in great heat over extremely broken country. We also obtained a group of the kakar, or barking deer,—a pretty little animal, somewhat resembling the roe deer of Europe.

Among the other animals secured by the expedition in Burma were two kinds of bamboo rat and various kinds of snakes, including two specimens of Russell's viper.

Answering certain inquiries made by President Osborn, Colonel Faunthorpe had written, previous to the letter just quoted, that there are two kinds of rhinoceroses still living in Burma and Siam (1) *R. sondaicus* and (2) the two-horned *R. lasiotis*, related to the *sumatrensis*. Both these animals are much smaller than the great Indian one-horned *R. indicus*, of which the expedition secured a very fine series in Nepal and which occurs also, although rarely, in Assam. There are very few of *sondaicus* and *lasiotis* living in Burma and Colonel Faunthorpe states that the government has recently prohibited the shooting of them,—perhaps too late. *R. sondaicus* occurs also in the almost impenetrable swamps of the Bengal sunderbund, or at least used to be there.

A Survey of the Expedition.—Mr. Vernay reached England late in June and some excerpts from a letter which he wrote at that time to President Henry Fairfield Osborn may fittingly be quoted in conclusion as a summary of the work of the expedition and as an evidence of the spirit that has actuated those in charge of it.

I arrived in England on Sunday last, and am having prepared a complete list with field notes of the various specimens Colonel Faunthorpe and I have obtained. This will be forwarded in due course. We are very pleased with the results of the expedition, and I think that within the six months we have had all the good fortune that we could possibly expect. Every assistance has been given us by the British government as well as by various ruling princes. Without this help and the extremely able organization conducted by Colonel Faunthorpe, the obtaining of the collection would have been impossible. In birds we have not been particularly successful, as the original ornithologist whom we hoped to obtain, died a few months before our arrival in India. Mr. Jonas [the preparator designated by the Museum to accompany the expedition] has done his work extremely well, and I think all of the skins and skeletal material will arrive in perfect condition. As far as possible the skins have been shipped to the Museum in tin-lined cases, hermetically sealed. The bones have all been poisoned and sent in wooden cases. . . .

We have taken a number of interesting photographs, many of which will be of great assistance in the mounting of the specimens. We have taken actual photographs of the jungle, or whatever might be the character of the place where the animal was shot. We also had moving pictures taken expressly for the purpose of showing environment. The chinkara country, for instance, has a peculiarity of its own, and a few feet of moving pictures will give the taxidermist a better idea of its character than any quantity of ordinary photographs. Our motion-picture films should prove interesting as we have wild elephant within a few feet of the camera, tiger within seven yards of the camera, tiger charging elephant, tiger running across a *nullah*, black buck, swamp deer, chital, nilgai, scenes connected with the ringing of tiger in Nepal, and many others.

In closing Mr. Vernay writes:

The great point of the whole thing is that we do feel that this expedition is really going to have, although in a very small way, the effect of creating in some channels better feeling between our two countries. Although it is only a very small brick in the building of a great friendship which is daily increasing, every brick counts, and if a few other people would supply a bit of mortar here and there, instead of tumbling the bricks down, the world would surely be a happier place.

To my mind England and America stand for the best there is in our civilization today. A perfect understanding between the two countries, an understanding which would be apparent to the whole world, would mean a world peace.

THE THIRD ASIATIC EXPEDITION

Latest Reports from Mr. Roy Chapman Andrews.—The leader of the Expedition, sends the following stirring budget of news from the field:

In Camp, Erhlien (Iren Dabasu)
May 15, 1923.

I returned to camp four days ago and found all well. I can also report progress—in fact, so much progress that it is going to be difficult to get away from here. Just before I left Camp Granger, Morris and I made an exploration trip to the east to follow out the Cretaceous exposure which we suspected must reappear before long. We found it eight miles from camp and also saw much fragmentary dinosaur material lying about on the surface. While I was gone the men prospected the exposure and found a really extraordinary deposit of dinosaur bones. The whole ridge seems to be full of them. We think there is work here for three or four men for an entire season.

Johnson found an enormous "mine" of bones where there are carnivores and herbivores mixed up in a great mass. This makes it difficult to remove the material but there may be enough to mount skeletons of both types.

THE THIRD ASIATIC EXPEDITION ON ITS WAY TO IREN DABASU, APRIL 21, 1923

While the camel train trudges on, the swifter units of transportation are making a halt until repairs have been completed on one of the trucks

They have exposed complete tails of both a carnivore and herbivore lying one on top of the other, as well as complete limbs and feet and many vertebræ, some with ribs attached. Also some skull bones and, at the moment, about 16 jaws with teeth. The "mine" is only half worked out and already there is enough for paper restorations of both types—whether or not there will be sufficient to mount skeletons we do not know as yet. I think there will be, because I am an optimist. Half a dozen complete feet and limbs have been removed and many separate bones in good condition.

The new men are much excited and Olsen says, "Why the whole hill is full of bones. I can't start to work around one before I strike another." Yesterday we packed boxes with what has already been removed and have about 800 pounds. That, you must remember, is with the "mine" only half worked out. There is so much stuff that I will have to send a car back to Kalgan with it—we can't carry it on with us. If we keep on at this rate you might as well start building operations on another wing for the Asiatic Hall! The herbiverous dinosaurs seem to be of the *Iguanodon* type rather than *Trachodon*, and the carnivores are both large and small types. As yet we have found no jaws of the carnivores but the herbiverous jaws are abundant and remarkably complete.

In Camp, Irden Maunah
May 25, 1923.

It is impossible to write with ink for a terrible storm is roaring and the sand sifts on my paper so rapidly that a pen will not write. For five days we have been having the most "beastly" weather I have ever known in Mongolia—terrific gales and such sand storms that we can see only a few hundred yards. The basin below us is simply smoking with yellow clouds of sand and everything in our tent is inches deep in sand. We have been able to work only one day since we came, for the gale has not ceased for five days.

The day after we arrived here—the only one in which we could do prospecting—Granger found the most beautiful titanothere skull you could ever wish to see. It is the *Diplacodon* type with horn knobs about two inches high and almost as perfect as though the animal had died last week. I understand there is only one other—that at Princeton. Right under the skull was an extra pair of lower jaws of a somewhat larger individual—absolutely perfect. Twenty feet away was another skull but that one seems to be somewhat broken, though it has not yet been excavated because of the weather. On the same day Olsen found and removed a fine palate of the same beast—also several jaws of lophiodonts—all these were found in the *first day's* prospecting, so you see what a rich spot this is.

I went up to see Johnson and Kaisen yesterday. We left them at the dinosaur quarry in Erhlien 23 miles away. They say that the bone is getting better and better the farther they go down. They have enough for mounts of both large *Iguanodon* and smaller carnivore types—legs, feet, and jaws complete of other individuals and the quarry shows no sign of being worked out. It is a remarkable place.

While I am away in Urga, they will continue to work at Erhlien on the dinosaurs. Olsen, Granger, and Morris will stay at this camp, working in the upper Eocene.

ARCHÆOLOGY

INVALUABLE GIFT FROM THE NATURAL HISTORY MUSEUM AT BRUSSELS.—The American Museum has just received from the Natural History Museum at Brussels an invaluable gift of flint implements representing the entire Palæolithic and Neolithic systems of Prof. A. Rutot, the distinguished head of the archæological department of the Brussel's institution. The collection includes a succession of industries going back to Oligocene time, namely:

I. Industrie Fagnienne, middle Oligocene, from Boncelles, 52 pieces
II. Industrie Pre-Chellenne, base of the Lower Quaternary, from Spiennes, near Mons, 51 pieces
III. Industrie Strepyenne, Lower Quaternary, from Spienne and Strepy, 42 pieces
IV. Industrie Chellenne, Lower Quaternary, from the valleys of the Haine and the Trouville, 22 pieces
V. Industrie Acheulenne inferieure, middle Quaternary from the valley of the Haine, 6 pieces
II*bis*. Industrie Reutelienne, Lower Quaternary, from Elonges and Hornu-Wasmes, 26 pieces (Contemporary with the Pre-Chellean.)
IV*bis*. Industrie Mafflienne, Lower Quaternary, Exploitation Hardenpont at St. Symphorien, near Mons, 16 pieces (Contemporary with the Chellean)
V*bis*. Industrie Mesvinienne, middle Quaternary, Exploitation Helin at Spiennes, 34 pieces

NEOLITHIC

A. Industrie Flenusienne, commencement of modern epoch, from La Flenu and Spiennes, 27 pieces
B. Industrie Spiennienne, middle of the Neolithic, from Spiennes and St. Symphorien, 57 pieces

Each of these industries, certain of which are in dispute among archæologists, is represented by a valuable series of implements bearing the inscription of Professor Rutot.

This gift greatly strengthens the collection of European archæology which President Henry Fairfield Osborn, vigorously aided by Mr. N. C. Nelson, associate curator of archæology, American Museum, has been bringing together for years past. This acquisition will be arranged in a case by itself, showing the entire Rutot System of classification of the Pre-palæolithic, the Palæolithic, and the Neolithic, which has been extensively quoted, as in a recent work of Professor Harris Wilder, *Man's Prehistoric Past*. The gift is another evidence of the very generous feeling which the Belgians and the Belgian insti-

tutions of science entertain for the American Museum. Our readers will recall the splendid ethnological collection presented to the Museum by King Leopold, as well as the coöperation of the Belgian government in connection with the obtaining of the Congo collection.

THE ANTIQUITY OF MAN.—A paper on this ever interesting problem, prepared jointly by Professor Henry Fairfield Osborn and Dr. Chester A. Reeds and published by the Geological Society of America, under the title, "Old and New Standards of Pleistocene Division in Relation to the Pre-history of Man in Europe," has attracted favorable comment in France and Germany. Dr. Ch. Barrois, now the senior geologist of France, wrote Professor Osborn under date of January 20, 1923:

Je vous prie d'agréer mes remerciements pour les beaux et intéressants mémoires que vous avez bien voulu m'adresser. Votre synthèse de nos connaissances sur les divisions du Pleistocène et le préhistoire de l'homme est ce que nous avons de plus complet, de plus judicieux, de plus pondéré en même temps que de plus élevé sur la matière. Je vous en félicite bien vivement en même temps que je vous en remercie. Je le transmets à mon assistant M. Dubois qui étudie depuis quelques années les formations Pleistocènes de nos côtes françaises, et en tirera, j'espère, meilleur parti que moi, à l'age où je suis arrivé.

Professor Charles Depéret, the leading authority in France on the correlation of the Age of Mammals and of the Age of Man, wrote (June 7, 1923):

Mon cher confrère et ami:

Je suis vraiment impardonnable d'etre resté si longtemps sans vous écrire pour vous remercier de l'amicale bienveillance avec laquelle vous avez bien voulu exposer et défendre pour les lecteurs de langue anglaise mes essais de coordination générale des temps quaternaires, en partant de la base des formations marines. Je vous en suis profondément reconnaissant et j'ai la certitude que votre puissante intervention contribuera beaucoup à répandre et á faire triompher la thèse que je soutiens. Naturellement, comme toutes les choses un peu nouvelles, cela suscite des objections et des resistances de la part des anciens, habitués á d'autres idées, et qui ne veulent pas en changer. Mais l'appui que j'ai trouvé auprès de vous en Amérique, auprès de MM. Sollas et Dewey en Angleterre, de MM. Ternier, de Margerie, Kilian, etc. en France, Lugeon en Suisse etc., etc., me font espérer un succès definitif peu éloigné. Je n'ai pas voulu, à dessein, aborder de front les causes premières des changements de niveau des mers et des fleuves, c'est-à-dire en somme les théories de la déformation de la terre; cela m'eut mené trop loin et sur un térrain trop difficile. J'ai préféré m'en tenir pour le moment au térrain solide des faits. Merci encore et du fond du coeur.

Following the discussion of the antiquity of man in Osborn's *Men of the Old Stone Age* of 1914, the Reeds-Osborn paper of 1922 is another attempt to make a complete synthesis of the thirteen parallel changes in the earth history and the life history of western Europe during the Age of Man. It is very gratifying to know that two of the leading geologists of France welcome this synthesis, are favorably disposed toward it, and do not regard it as an intrusion into their special fields of work.

LES FIANCÉES DU SOLEIL BY V. FORBIN.—The appeal of the dim beginnings of human society is evidenced not only by the strictly scientific studies prepared by archæologists but by works of fiction in which the authors have interwoven romance and fact for the interest and stimulation of their readers. *Les Fiancées du Soleil*, by V. Forbin, is a recent addition to this group of fiction, dealing as it does in vivid style with what from the standpoint of culture is perhaps the most interesting of the early races of man, the Crô-Magnon. Monsieur Forbin's story gives a spirited account of the triumph of the intellect over brute force, of the spirit of invention and reason rising in mastery over the obstacles existing in the rude world at the close of the Glacial Period. Naturally one looks to a work of fiction for a dramatic and artistic presentation of life rather than for a literal rendering of fact, and M. Forbin is too conscious of the proper mission of fiction to permit himself to be fettered by details that might be obstructive to the development of his story. Nevertheless, M. Forbin has the advantage over many other writers of fiction in being genuinely interested in science, an advantage which is bound to manifest itself when he turns, as in the present instance, to a subject that has been a fruitful field of scientific investigation by scholars in Europe and America. To one of these, Prof. Henry Fairfield Osborn, of the American Museum, the book is dedicated by the author.

ARRANGEMENT OF THE ARCHÆOLOGICAL COLLECTIONS.—It is probable that the exhibition hall in the American Museum containing side by side the archæological collections of Europe and America will be named the hall of the prehistory of man. The collections from America are very extensive although in many special fields far behind those of other mu-

seums. The collections from Europe are growing so rapidly that the hope seems justified that there will soon be a very representative sequence from the beginning to the end of the Stone Age and on into the Bronze Age. The collections of New Stone Age have just received a rich accession of Swiss dwelling material, which will be noted in a later number of NATURAL HISTORY when the contents of the shipment are more fully known. During the last winter Mr. N. C. Nelson, associate curator of archæology, classified about 4000 old-world archæological objects and catalogued nearly 3000 of them. A part of this material, such as the type specimens from Chelles, has been placed on view,—but further exhibits are planned when new cases can be prepared for the reception of this collection. The major part of Mr. Nelson's time for two or three years past has been taken up with the American collections. With the constant accumulation of new archæological material it is imperative that proper storage space be provided through the condensation of old material as a preliminary to the proper revision of the collections themselves. Some day the department of anthropology of the Museum will have a larger archæological staff, capable of assisting Mr. Nelson in arranging the archæological material so that it will connect with the prehistory of man as displayed in the hall of the Age of Man and in the exhibits of physical anthropology prepared by Dr. Louis R. Sullivan.

AWARD OF THE ROOSEVELT MEDAL OF HONOR

PROMOTION OF NATURAL HISTORY.—The Roosevelt Memorial Association appointed the following committee to consider the award of its first three Medals of Honor: Dr. John H. Finley, chairman, Col. William Boyce Thompson, Secretary of Agriculture, Henry Cantwell Wallace, Governor Gifford Pinchot of Pennsylvania, the Hon. Oscar S. Straus, who was Secretary of Commerce and Labor in President Roosevelt's Cabinet, and Mrs. C. Grant La Farge. The recipients chosen by the committee were General Leonard Wood, especially for his "promotion of the national defense"; Miss Louisa Lee Schuyler for her service in promoting the welfare of women and children; Prof. Henry Fairfield Osborn for the promotion of the study of natural history. The ceremony of presentation took place in the east room of the White House on Friday, June 15, at four-thirty. President and Mrs. Harding, several members of the Cabinet, the French Ambassador, and a large number of representatives of the Roosevelt Memorial Association and other distinguished guests were present. Addresses on behalf of the Association were made by Director Hermann Hagedorn. The medals were handed to President Harding, who with brief and appropriate remarks presented them to the recipients or their representatives. As shown in the accompanying illustrations, the medal, designed by James Earle Fraser, is after the

The Roosevelt Memorial Association Medal of Honor, bestowed upon Professor Henry Fairfield Osborn of the American Museum for his "promotion of the study of natural history." The presentation of the medal was made by President Harding shortly before he undertook his trip to Alaska

style of Italian models of the school of Vitore Pisano, of the middle of the fifteenth century. The face of the medal bears a superb head of Theodore Roosevelt, with the years of his birth and death, MDCCCLVIII and MCMXIX, and the words "For distinguished service" above. In the center of the obverse is a flaming sword, across which is written, "If I must choose between righteousness and peace I choose righteousness." Encircling the medal are the words "Roosevelt Memorial Association Medal of Honor." The rim of the medal awarded to the President of the American Museum is inscribed "To Henry Fairfield Osborn for the promotion of the study of natural history." In his brief speech of presentation President Harding said:

It is a very rare distinction to have so pursued one's activity as to earn the devoted and trusted friendship of the late Theodore Roosevelt, and it is a very great distinction, sir, to be at the head of what is rated to be the leading institution of its kind in the world. And now, sir, it is an added distinction to have from this source a mark of tribute and approval which I know that the late Colonel Roosevelt himself would most cordially approve. It is a pleasure to be the agency of transmission, and I beg to bestow the medal in the name of the Roosevelt Memorial Association, with my very cordial congratulations.

The medal was accepted by the President of the Museum as a tribute on the part of the Roosevelt Memorial Association and the President of the United States to the work which the American Museum is doing in the promotion of the love and study of natural history throughout the United States.

The Roosevelt Memorial Association, under the presidency of Col. William Boyce Thompson and the direction of Mr. Hermann Hagedorn, has raised a very large sum for the erection of a national memorial to Theodore Roosevelt in the city of Washington. The character of the memorial has not yet been decided upon, but prominent among the designs under consideration is the monumental statue of a lion by Mr. Carl E. Akeley.

A PERMANENT MEMORIAL TO ROOSEVELT

THIRD MEETING OF THE MEMORIAL COMMISSION.—New York State will not be behind the nation in keeping alive the memory and influence of its most distinguished son. The original Roosevelt Memorial Commission of the State of New York was appointed by Governor Smith and the presiding officers of the State Senate and Assembly in 1920, and the Commission expects to make its final report to the Governor and the Legislature upon the opening of the Legislature of 1924. The many projects brought before the Commission from all parts of the state and country have been considered with great care and at the second meeting, held in Albany, the following resolution proposed by Mr. Kiernan was unanimously adopted:

Resolved: That it is desirable to adopt a form of memorial which may be utilized for scientific, educational or administrative purposes and thus reflect the chief activities of Colonel Roosevelt's life.

Since the purposes of the Commission were clearly declared in this resolution, no further suggestions have been received as to the character of the state memorial. The Regents of the State of New York were especially invited to prepare and present what may be known as the City of Albany plan of a memorial; similarly the Trustees of the American Museum were invited to prepare and present what may be known as the City of New York plan of memorial. The third meeting of the Commission was called in the American Museum on Wednesday, June 27, to receive the delegates from these two bodies. The following members of the Commission were present: Henry F. Osborn, Chairman, Senator George L. Thompson, Senator Samuel J. Ramsperger, Louis A. Cuvillier, Peter D. Kiernan, George N. Pindar, Secretary.

The City of Albany plan was presented by the Hon. William Bondy and by Dr. John M. Clarke, director of the State Museum. It provides for a new natural history museum, to be erected in the City of Albany on a site presented by the City Council, at an estimated cost of $5,000,000; it is proposed to call the institution the Theodore Roosevelt Museum of Natural History; it is planned that the eastern wing of the museum shall be constructed first, at an estimated cost of $1,493,000, leaving the center and western wings to be built at a later date.

The City of New York plan was presented by four speakers as follows: Albert Gallatin, Commissioner of Parks, designated Manhattan Square, to be renamed Roosevelt Square, as the site, to be approached from the eastern side of the city by an intermuseum promenade which, it was suggested, might be called "The Roosevelt Trail"; Mr. A. Perry Osborn, of the Board of Trustees of the American Museum, presented the general object and purpose to be attained by the erection of a monumental

Exterior view

Interior view

CITY OF NEW YORK

PROPOSED

THEODORE ROOSEVELT

MEMORIAL

Plan

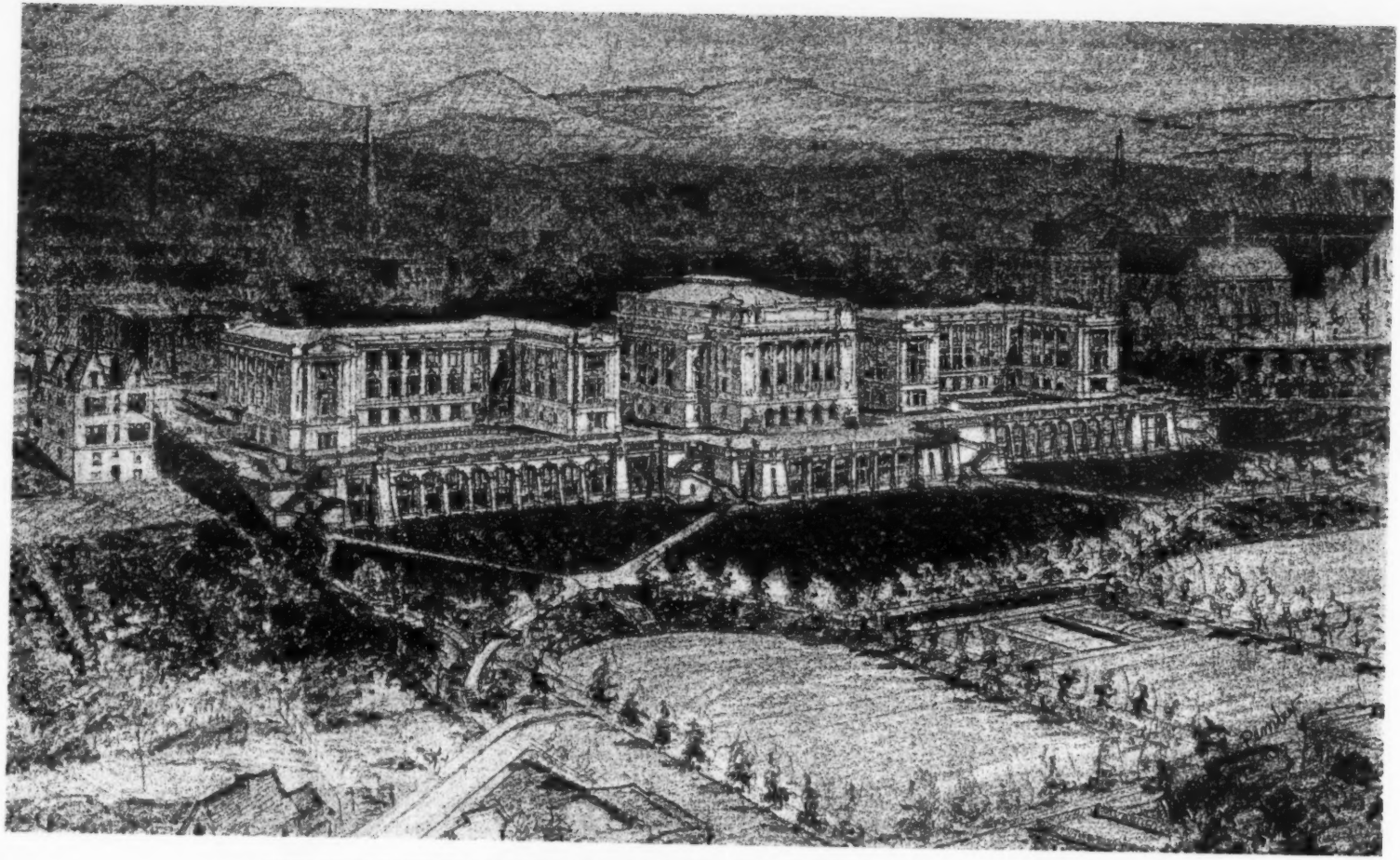
as presented by the

Trustees of the

American Museum

June 27, 1923

UNIV. OF MICH.



CITY OF ALBANY PROPOSED THEODORE ROOSEVELT MUSEUM OF NATURAL HISTORY
Plan as presented by the Regents, June 27, 1923

building on this site; Mr. Breck Trowbridge, for the firm of Trowbridge & Livingston, architects, described the character of the building, both interior and exterior, as designed to dominate not only the American Museum building group but the west side of Central Park; Mr. Akeley outlined the plan and purposes of the Roosevelt African Hall, of which he is the originator and designer.

After the two plans had been clearly presented and discussed, the Commission held an executive session, in which both plans were more thoroughly considered. It was agreed to withhold decision until the autumn; in the meantime to confer with the State architect and with Governor Smith. This matter is of such interest to the readers of NATURAL HISTORY, not only in various parts of New York State but throughout the country, that both building plans are shown on the two preceding pages.

FISHES

COMPLETION OF "BIBLIOGRAPHY OF FISHES."—The great *Bibliography of Fishes*, which has been in progress for thirty years under the direction of Dr. Bashford Dean, honorary curator of ichthyology, American Museum, is at last completed. The sheets of the third or index volume have just come from the printer and as soon as the binding is completed the entire work will be ready for distribution. The President and Trustees of the Museum have strongly supported this monumental undertaking by Doctor Dean and his splendid staff of collaborators, in the belief that this Bibliography will be a permanent contribution, not only to ichthyology and natural history in general but to every branch of human welfare and activity directly or indirectly connected with the life of fishes.

When the publication appears, NATURAL HISTORY will give an adequate review of the entire series of volumes. In the meantime it is pleasant to record the praises which the two volumes of the work are receiving from naturalists in various parts of the world. Among these tributes may be cited the following:

"Your bibliography is clearly a work of the greatest importance, not merely to specialists in ichthyology, but to all interested in the morphology of vertebrates in general. Its publication will do much to accelerate the advent of the day when workers on the anatomy of man and the higher vertebrates will realize that a sound morphology of the higher vertebrates must be founded on a sound morphology of the lowest members of the group Vertebrata." (Prof. J. Graham Kerr, University of Glasgow, contributor of the morphological part of the article on Ichthyology in the *Encyclopædia Brittanica*, author of *Text-book of Embryology* and numerous other works.)

"I feel that you are indeed greatly to be congratulated upon this magnificent 'subject catalogue' which will be an absolutely invaluable work of reference to all interested in the morphology of vertebrates. I hope it will not be many months before I have a copy of the new volume on my shelves." (Prof. J. Graham Kerr).

"You seem to me to have been most successful in condensing so much accurate information in so little space, and I feel sure your work and indeed the whole of the Bibliography will prove of great value to zoölogists." (Prof. Edwin Stephen Goodrich, University Museum of Oxford, author of "Cyclostomes and Fishes" in the *Treatise on Zoology* edited by Sir E. Ray Lankester.)

"I will be most glad to see the final result. I certainly approve of the way it is done. These little summaries of each morphological section will prove of great value. . . it will be worth all of the labor it has cost." (Prof. John Sterling Kingsley, distinguished American comparative anatomist.)

In various stages of this work Doctor Dean has had no less than twelve collaborators, several of whom, like Doctors Eastman and Gudger, have devoted their entire time to it and to all of whom the ichthyologists of the world are under lasting obligations.

GEOLOGY

DOCTOR HOVEY VISITS AUSTRALIA AND NEW ZEALAND.—On June 29 Dr. E. O. Hovey, curator of geology and vertebrate palæontology, American Museum, sailed from Vancouver, British Columbia, for Sydney, Australia. He represented not only the Museum but also the Geological Society of America and the New York Academy of Sciences at the Second Pan Pacific Scientific Conference, which was held in Sydney and Melbourne from August 13 to September 3. He was commissioned by President Henry Fairfield Osborn to relate to the conference some of the striking results obtained by the Third Asiatic Expedition, and to announce the palæontological studies of Professor Osborn and Dr. William D. Matthew and the

geological investigations of Prof. Charles P. Berkey and Doctor Morris. Doctor Hovey also planned to give a statement of the achievements of the Whitney South Sea Expedition and to present the paper by Dr. Chester A. Reeds entitled "Seasonal Records of Geologic Time," which appears in the July–August issue of NATURAL HISTORY, pp. 370–380.

Doctor Hovey expects to utilize the opportunity which his sojourn in Australia affords, of viewing the famous mining district of Broken Hill, New South Wales, and other places of geologic interest, including a few of those which offer light on the various glacial periods that have visited the continent. His itinerary includes on the return journey a stay of four weeks in New Zealand, where he expects to visit the famous geyser and hot-spring region and one or two of the other volcanic areas in the north island, and the glacial regions in the south island, for the purpose of obtaining information that will be of value in the construction of additional relief models at the Museum. The important museums in the two countries will be visited; exchange relations with those in New Zealand will be established and such relations now enjoyed with the museums of Australia will be extended.

PUBLIC EDUCATION

THE AMERICAN MUSEUM AND THE TRAINING SCHOOLS FOR TEACHERS.—The opportunities offered by the American Museum to the schools of Greater New York are of an unusual character and it is important that prospective teachers should know just what facilities are at their disposal so that their classes may benefit to the utmost. With this thought in mind, the American Museum entertained on June 15 the faculty and graduating class of the New York Training School for Teachers, and on June 27 the faculty and graduating class of the Maxwell Training School for Teachers. Following the precedent of other years, there was a lecture on the Museum's work with the public schools, delivered by Dr. G. Clyde Fisher, a demonstration, respectively by Mrs. Ruth Crosby Noble and Mrs. Grace Fisher Ramsey, of the use of slides and of motion pictures for purposes of instruction, and a tour under the guidance of members of the scientific staff through the several exhibition halls. In conclusion refreshments were served. Director F. A. Lucas gave the address of welcome at the gathering on June 27 and Dr. Gustave Straubenmüller, associate superintendent of schools, expressed his great esteem for the educational work of the Museum.

CONSERVATION

STATEN ISLAND AND ITS PARK AREA.—It is to be hoped that there may be no hesitation in complying with the suggestion made at a recent meeting of the Staten Island Bird Club, namely, that a part at least of the area set aside for park purposes in Staten Island be preserved in its natural condition. As the population of Greater New York expands, more and more land is denuded of its native wild flowers. Brick and stone and stucco encumber the landscape, or, at best, flowerless lawns and artificially reared plants—many of them foreign to our flora—replace the rightful possessors of the soil. The character of a region is determined not only by its institutions and customs, its historic monuments, and the collective personality of its inhabitants, but by the surface aspect of the landscape. Scotland would be incomplete without its heather, Switzerland would lose something of tangible as well as sentimental value if deprived of the edelweiss. The daisy, the goldenrod, the spring beauty, and the Jack-in-the-pulpit are not to be despised. Animal life, notably in the case of the insects, is not infrequently associated with a particular plant or group of plants, and the destruction of our native flowers and shrubs has therefore resulted in a serious diminution of the creatures dependent upon them. The action of the Staten Island Bird Club is a timely reminder that precautions should be taken to the end that at least a few spots of native interest in our municipalities may escape the all-too-prevalent tendency to root out the growths planted by nature and introduce in their stead the growths planted by man.

SOUTH AMERICA

MAMMAL COLLECTING IN ECUADOR.—On July 14, Mr. H. E. Anthony, associate curator of mammals of the Western Hemisphere, sailed for Guayaquil, Ecuador, whence he will proceed to the high Andes for a collecting trip of several months' duration. Much attention will be given to the region about Chimborazo and Pichincha (the peak at the base of which lies Quito) and to other elevations which, while less imposing than Chimborazo with its more than 20,000 feet, yet rise to heights greater than those of the loftiest peaks in the Alps. Many of these mountains are either semi-active volcanoes or have been in violent

eruption in the past; they are not links in a continuous chain but more or less isolated heights rising out of a basal plain. Mountains of this character, like islands scattered over the sea, often develop their own peculiar fauna, and one of the objects of the expedition is to ascertain to what extent this insular environment has produced distinct forms of animal life.

Among the animals of more spectacular interest which, it is hoped, may be obtained in these high altitudes is the tiny deer known as the *Pudu*, the closest relative of which is found in Chili, where the more southern latitude affords at lower elevations zonal conditions approximating those of the high mountains near the Equator.

If it is possible to do so, Mr. Anthony wants to make a zoölogical cross section through the easternmost range of the Andes, near the boundary of Colombia and Ecuador. The fauna of this region is not particularly well known and specimens secured there will be valuable for purposes of comparison with those obtained in a similar cross section made through Rio Zamora in southern Ecuador, near the Peruvian boundary.

One of the objects of the expedition will be the collecting of a representative series of specimens from the fossil deposits at Punin, near Riobamba. Here, in an extensive bed of volcanic ash, have been found the remains of the Andean mastodon, camels, horses, ground sloths, deer, and other forms. Through the generosity of Mr. Childs Frick it will be possible to work these fossil beds and obtain from them a representation of this South American fauna for the Museum.

Mr. Anthony is accompanied on the expedition by Mr. G. H. H. Tate, who awaited him when he disembarked at Guayaquil. In a letter which Mr. Tate addressed to Mr. Anthony before the latter's departure, he reported that he was meeting with good success in his collecting in the Sierra de Colonche in western Ecuador. Here Mr. Tate worked in in an exceedingly humid forest, the conditions of which were in sharp contrast to those of the markedly arid coastal strip lying immediately to the westward. Practically no zoölogical collecting has been done in this range of mountains and the specimens taken by Mr. Tate are eagerly awaited at the Museum. Although Mr. Anthony plans to return to the Museum about the middle of November, Mr. Tate will continue working over the Ecuadorian field until the spring of 1924.

THE EXPEDITION OF THE "NOMA" TO THE GALÁPAGOS ISLANDS.—Lying for the most part just below the Equator, more than seven hundred miles west of the coast of Ecuador, the Galápagos Islands are rather far removed from the normal routes of travel and but few naturalists have been so fortunate as to reach them and observe at first hand their peculiar fauna and flora, which Darwin described as "eminently curious." In the waters surrounding these islands and on the rocky sea beaches is found a genus (*Amblyrhynchus*) of marine lizards that is highly specialized for life in the sea; the giant tortoises of the Galápagos, which share with the huge East Indian turtles the distinction of being the most spectacular and ponderous of all existing tortoises, although now on the way to extinction, formerly existed there in large numbers; while, thanks to the cold waters of the Humboldt Current, penguins, which we normally associate with the ice-bound shores of the Antarctic, exist on these islands although exposed to the merciless glare of the equatorial sun.

Due to the generosity of Mr. Harrison Williams, through whom the steam yacht "Noma" was made available for the purpose, Mr. William Beebe, director of the Tropical Research Station of the New York Zoological Society, was recently able to visit the Galápagos with twelve of his associates and to make a very full record of the animal life which it contains. The greater number of specimens were brought back alive and have joined that cosmopolitan community of animals, including representatives from practically all parts of the world, which is maintained at the Zoological Park in the Bronx. Other specimens have come into the possession of the American Museum. Among the latter are a family of sea lions, eighteen lizards, and a giant tortoise. This tortoise, captured on Duncan, was the only one of these monsters that the members of the expedition encountered,—a melancholy contrast with former days when, it is said, single vessels would carry off hundreds of these reptiles.

Darwin, who visited the islands in the course of the voyage of the "Beagle," noted the extraordinary tameness of the birds. "All of them approached sufficiently near to be killed with a switch, and sometimes, as I myself tried, with a cap or hat. A gun is here almost superfluous; for with the muzzle I pushed a hawk off the branch of a tree. One day, whilst lying down, a mocking-thrush

alighted on the edge of a pitcher, made of the shell of a tortoise, which I held in my hand, and began very quietly to sip the water; it allowed me to lift it from the ground whilst seated on the vessel: I often tried, and very nearly succeeded in catching these birds by their legs."

Mr. Beebe's experiences prove that as in Darwin's day the creatures of the Galápagos still show little fear in the presence of human beings: "The instantly arresting feature was the astounding tameness of all the creatures. Having never seen human beings they had little fear, the birds and sea-lions being particularly indifferent to us. Perhaps indifference is hardly the word, since in many cases they showed great curiosity about us. Mocking birds would follow us along, hopping from branch to branch within arm's reach; little flycatchers would perch a foot from our faces, in close inspection of our mystifying presences."

DINOSAUR EGGS DISCOVERED

As this issue goes to press, a cable report reaches the American Museum of the remarkable find by the Third Asiatic Expedition, in the course of its explorations in Mongolia, of no less than seventy skulls and ten skeletons of primitive horned Ceratopsian dinosaurs and contemporary carnivorous dinosaurs. This collection, which is one of the most superb brought together in so brief a time, derives additional scientific importance and popular interest from the fact that included in it are three nests and twenty-five dinosaur eggs. This is the first actual discovery of the eggs of dinosaurs and establishes as a certainty what heretofore could be designated merely as a strong probability, namely, the egg-laying habit among the dinosaurs. The expedition also secured a large series of remains of fossil mammals from six distinct horizons in the early part of the Age of Mammals. These are mostly those of new and interesting kinds of extinct animals and will furnish important evidence on the theories of the dispersal of animals from a central Asiatic source.

Since the last issue of Natural History the following persons have been elected members of the American Museum, making the total membership 7040.

Life Members: Mesdames Robert G. Elbert, S. Z. Mitchell; Miss Dorothy Oak; Messrs. Walter Scott, J. H. Wade, and Park M. Woolley.

Annual Members: Mesdames Winthrop M. Crane, Jr., Carl A. de Gersdorff, Wyllys Terry, B. H. Vredenburgh, G. De Witt Williamson; the Misses Amelia E. Cameron, Helen Louise Lewengood, Alice Lind, J. S. Roosevelt, Ida Ruperti, Estelle Whitfield; Edward Levenson, D.D.S.; Messrs. Chester Alexander, George H. Bissinger, Douglas J. Crawford, Wm. E. Gifford, Chauncey J. Hamlin, Adam Ogint, Joseph Spektorsky, Harry F. Stratton, A. G. Van Nostrand, and James P. Woodruff.

Associate Members: Mesdames A. N. Burk, Robert Codman, John Clarence Egan, J. A. Gould, F. N. Iglehart, H. F. Lyman, Arthur M. Marsh, W. E. McLean, Galbraith Miller, Jr., Leila Y. Post Montgomery, A. St. J. Newberry, Lee Newbury, Sarah A. Turnbull, H. F. Vickery, Andrew B. Wallace, Harwood Otis Whitney; the Misses Margaret E. Chase, Mary Wood Daley, M. Annie Miller, Elisa W. Redfield, Ruth N. Reeves, Myra Valentine, Mary C. Wheelwright; Sir Harry H. Johnston, Sir Ray Lankester; the Hon. Louis Will; Colonel M. L. Crimmins; Doctors Frank D. Adams, F.R.S., H. C. Bliss, Herman L. Fairchild, Edward C. Franklin, Francis R. Hagner; Professors Edward Phelps Allis, Jr., L. Bolk, L. Cuénot, Henry S. Jacoby, Roy L. Moodie, T. Odhner, Otto T. Walter, Max Weber; Messrs. Carl L. Alsberg, Barnard S. Bronson, J. J. Carroll, Willard M. Clapp, Edw. S. Dana, Kimball G. Easton, Carroll Lane Fenton, C. H. Foster, F. S. Gordon, Oliver B. Hopkins, W. J. Hunsaker, Thomas H. Kearney, Emil F. Kuithan, E. P. Lewis, M. Albert Linton, David S. Ludlum, Charles J. Lynn, A. Ware Merriam, Arthur N. Milliken, J. Merrick Moore, I. H. Morse, Gordon Parker, H. A. Parsons, George J. Pearl, Wm. R. Pentz, Casper L. Redfield, Max L. Rosenberg, Fred C. Schoenthaler, G. C. Schoonmaker, Theodore E. Shucking, Samuel S. Spaulding, Carl L. Spofford, Charles W. Stage, J. H. Steinmech, F. Paul Stevens, George H. Streaker, F. S. Streever, W. H. Sudduth, Arthur W. Sugden, Wm. J. Thistlethwaite, H. B. Van Duzer, John Sminck Van Epps, William Van Orden, Chas. W. Welch, W. R. Westcott, Eddy Whitby, Henry Nicoll Wightman, Ellison A. Williams, and Henry G. Wynn.

THE AMERICAN MUSEUM OF NATURAL HISTORY

FOUNDED IN 1868

MEMBERSHIP MORE THAN SIXTY-EIGHT HUNDRED

For the enrichment of its collections, for the support of its explorations and scientific research, and for the maintenance of its publications, the American Museum of Natural History is dependent wholly upon membership fees and the generosity of friends. More than 7000 members are now enrolled who are thus supporting the work of the Museum. The various classes of membership are:

Associate Member (nonresident)*	annually	$3
Annual Member	annually	10
Sustaining Member	annually	25
Life Member		100
Fellow		500
Patron		1,000
Associate Benefactor		10,000
Associate Founder		25,000
Benefactor		50,000

*Persons residing fifty miles or more from New York City

Subscriptions by check and inquiries regarding membership should be addressed: George F. Baker, Jr., Treasurer, American Museum of Natural History, New York City.

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COURSES OF POPULAR LECTURES FOR MEMBERS

A series of illustrated lectures, held in the Auditorium of the Museum on alternate Thursday evenings in the fall and spring of the year, is open only to members and to those holding tickets given them by members.

Illustrated stories for the children of members are told on alternate Saturday mornings in the fall and in the spring.

MEMBERS' CLUB ROOM AND GUIDE SERVICE

A room on the third floor of the Museum, equipped with every convenience for rest, reading, and correspondence, is set apart during Museum hours for the exclusive use of members. When visiting the Museum, members are also privileged to avail themselves of the services of an instructor for guidance.

The American Museum of Natural History has a record of more than fifty years of public usefulness, during which its activities have grown and broadened, until today it occupies a position of recognized importance not only in the community it immediately serves but in the educational life of the nation. Every year brings evidence—in the growth of the Museum membership, in the ever larger number of individuals visiting its exhibits for study and recreation, in the rapidly expanding activites of its school service, in the wealth of scientific information gathered by its expeditions and disseminated through its publications—of the increasing influence exercised by the institution.

In 1922 no fewer than 1,309,856 individuals visited the Museum as against 1,174,-397 in 1921, and 1,038,014 in 1920. All of these people had access to the exhibition halls without the payment of any admission fee whatsoever. The EXPEDITIONS of the American Museum, working during the past year in several parts of Asia—where finds of extraordinary value were made—in South America, Africa, Australia, Europe, in the South Pacific Islands, in the West Indies, and in selected areas of our North American continent, have greatly enriched knowledge. Many habitat groups, embodying specimens secured by these expeditions, are planned for the new Museum buildings, the erection of which has been authorized by the city.

The SCHOOL SERVICE of the Museum reaches annually more than 4,000,000 boys and girls, through the opportunities it affords classes of students to visit the Museum; through lectures on natural history especially designed for pupils and delivered both in the Museum and in many school centers; through its loan collections, or "traveling museums," which during the past year circulated among 475 schools, with a total attendance of 1,648,608 pupils. During the same period 330,298 lantern slides were loaned by the Museum for use in the schools as against 209,451 in 1921, the total number of children reached being 2,582,585.

LECTURES, some exclusively for members and their friends, others for the general public, are delivered both in the Museum and at outside educational institutions.

The LIBRARY, comprising 100,000 volumes, is at the service of scientific workers and others interested in natural history, and an attractive reading room is provided for their accommodation.

The POPULAR PUBLICATIONS of the Museum, in addition to NATURAL HISTORY, include Handbooks, which deal with the subjects illustrated by the collections, and *Guide Leaflets*, which describe some exhibit, or series of exhibits, of special interest or importance, or the contents of some hall or some branch of Museum activity.

The SCIENTIFIC PUBLICATIONS of the Museum, based upon its explorations and the study of its collections, comprise the *Memoirs*, of quarto size, devoted to monographs requiring large or fine illustrations and exhaustive treatment; the *Bulletin*, issued since 1881, in octavo form, dealing with the scientific activities of the departments, aside from anthropology; the *Anthropological Papers*, recording the work of the staff of the department of anthropology; and *Novitates*, devoted to the publication of preliminary scientific announcements, descriptions of new forms, and similar matters.

A detailed list of the publications, with prices, may be had upon application to the Librarian, American Museum of Natural History, New York City